Medium Voltage motor starter

Motorpact™ - 7.2 kV

Vacuum contactor

Catalogue

Schneider Electric

A new path for achieving your electrical installations

A comprehensive offer

Motorpact is part of a comprehensive offer of products that are perfectly coordinated to meet all medium and low voltage electrical distribution requirements. All of these products have been designed to work together: electrical, mechanical and communication compatibility.
The electrical installation is thus both optimised and has improved performance:
- better service continuity,
- increased personnel and equipment safety,
- guaranteed upgradeability,
- efficient monitoring and control.

You therefore have all the advantages at hand in terms of know-how and creativity for achieving optimised, safe, upgradeable and compliant installations.

Tools for facilitating the design and installation

With Schneider Electric, you have a complete range of tools to help you get to know and install the products whilst complying with current standards and good working practices. These tools, technical sheets and guides, design software, training courses, etc are regularly updated.

Schneider Electric is associating itself with your know-how and your creativity to produce optimised, safe, upgradeable and compliant installations

For a real partnership with you

A universal solution doesn't exist because each electrical installation is specific. The variety of combinations on offer allows you to truly customise the technical solutions.
You are able to express your creativity and put your know-how to best advantage when designing, manufacturing and exploiting an electrical installation.

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Field of application

MT20052

Motorpact, an innovative range of motor starters up to 3800 kW

Designed and manufactured to tackle the toughest power and process control challenges, Motorpact MV motor starters provide unmatched performance, high reliability, low maintenance and exclusive technologies that encourage only the safest operation.

Motorpact units can be configured as motor starters or as transformer feeders. Motorpact motor starters provide a wide range of applications including reduced voltage starting:

- FVNR: full voltage non reversing motor starter,
- RVAT: reduced voltage auto-transformer motor starter,
- RVSS: reduced voltage SoftStart motor starter.

They are suitable for all MV motor applications in markets such as oil & gas, mining, water, pulp and paper, for starting:

- pumps,
- fans,
- compressors,
- chillers,
- conveyors,
- …

Schneider Electric pre-designed solutions

The Motorpact catalogue provides Schneider Electric solutions for frequently used MV motor starter applications.

Our solutions are designed to save engineering time and to provide adequate protection and operation of the different systems.

Optional equipment and applications are available for specific requirements (please consult us).

PE55175

Schneider Electric certified quality

In each of its units, Schneider Electric integrates a functional organization whose main mission is to check quality and monitor compliance with IEC and/or NEMA standards.

This procedure is:

- uniform throughout all departments,
- recognized by many customers and approved organizations.

But above all, it is the strict application that has allowed it to obtain recognition from an independent organization.

The quality system, for the design and manufacture of Motorpact range, is certified in conformity with requirements in the ISO 9001: 2000 quality assurance standards.

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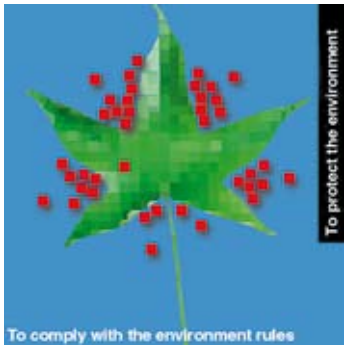


Protected environment

As part of the group's environmental policy, Schneider Electric Services provides you with an operational subsidiary to recover medium voltage switchgear and thus eliminate any discharge to atmosphere.

In order to help you protect the environment and to relieve you of any concerns in terms of stock or dismantling, Schneider Electric Services offers to take back your equipment at the end of its life.

Motorpact has been designed with environmental protection in mind:

- the materials used, insulators and conductors are identified, easily separable and recyclable.
- production sites are certified to ISO 14000.

Motorpact, the value of innovative design

Motorpact MV motor starters integrate innovative solutions designed around proven technologies: high performance digital protection and control, maintenance free disconnector, internal arc withstand capability, thermal diagnosis system,…

PE56476

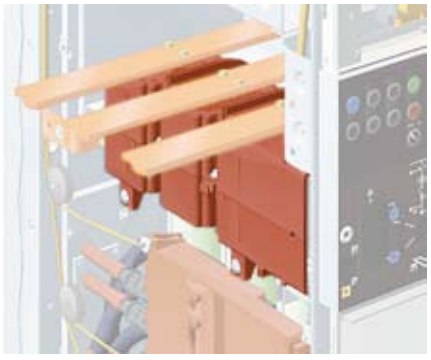
Safety

- Fully tested for internal arc resistance in all MV compartments.
- Fully safe compartmented design prevents inadvertent access to MV compartments.
- Viewing window provides visible disconnector earthed position from the front of the equipment indicating safe isolation of the starter from the busbars.
- Cable earthing switch with making capacity.
- Closed door operation.
- Simple interlocks prevent inadvertent operator errors.

Reliability

- Simple architecture with a line disconnector, which reduces the number of parts and provides simple and robust interlocks.
- Multifunctional cast components minimizes parts, consequently reduces maintenance and heat loss.
- Pre-engineered solutions with low power current transducer (LPCT) and Sepam digital relay provide proven designs for the full range of motor applications.
- Separate LV control cabinet enhances electromagnetic compatibility (EMC) and wire management.
- Global design complying with all relevant IEC and NEMA standards.

PE55132



Maintainability

- All necessary maintainable motor starter components accessible without the need of de-energizing the complete switchboard.
- Maintenance free vacuum contactor.
- High endurance maintenance free line disconnector.
- Thermal diagnosis system for predictive maintenance.
- Few spare parts.

Compactness and flexibility

- Compact footprint of 375 mm width.
- One design allows front, rear, top and bottom cable entries.
- Simple and compact transition cubicles allow extension to other Schneider Electric equipment.
- Ideal for retrofit applications.

Motorpact, a comprehensive solution

Motorpact MV motor starters provide the most efficient means to control and protect a wide range of applications.

PE55170

Sepam protection and control units

Sepam series 20, series 40 and series 80 digital protection relays take full advantage of Schneider Electric experience in electrical network protection.

Sepam series 20, series 40 and series 80 provides all the necessary functions:

- effective protection of people and property,
- accurate measurements and detailed diagnosis,
- integral equipment control,
- local or remote indication and operation.

Easy evolution

Addition of communication, digital I/O's, analog output, or temperature acquisition are possible due to its modular design.

PE55134

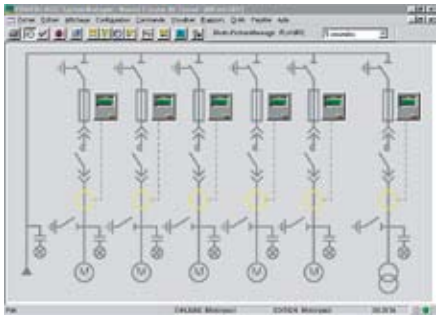
PowerMeter and Circuit Monitor metering units

The PowerLogic PowerMeter replaces a full complement of basic analog meters. This cost effective, high performance meter provides a full complement of accurate true-rms metering values.

The PowerLogic Series 3000/4000 Circuit Monitor is designed for critical power users and large energy consumers, to provide the information needed to confidently enter the evolving world of deregulation.

It can be adapted to meter almost any time-of-use or real-time rate.

PE55135



Monitoring and control

Motorpact Motor Control Centre can be easily:

- integrated into an existing monitoring and control system:

communication of Sepam digital relay, or PowerMeter/Circuit Monitor metering device through a standard protocol (Modbus).

- integrated into a SMS PowerLogic electrical installation monitoring system.

PE55136

Thermal diagnosis system

Specially designed for Schneider Electric MV equipment, this system continuously monitors the temperature rise, using optical fibres and sensors installed at the heart of the sensitive areas.

Thermal diagnosis system reduces the probability of failure and reduces maintenance time.

PE55137

Motorpact Transparent Ready™ option

Motorpact motor control centres integrate Web technologies so that you can find out information about your electrical installation as easy as opening a Web page.

All you need is a standard Web browser and a PC connected to your local area network.

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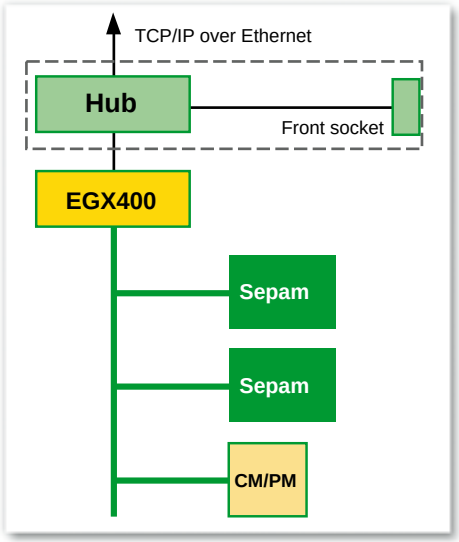


Motorpact motor control centre

Simple choice

A simple choice between TRe-1 and TRe-2 service levels allows you to easily order your Transparent Ready™ Motorpact switchboard.

A customised level is also available.

Transparent Ready™ Motorpact control centre comes equipped with a web server including web pages dedicated to power equipment data.

Easy commissioning

Transparent Ready™ equipment is delivered ready to connect and commission.

A Quick Start guide, packaged with your switchboard, provides three easy-to-follow steps.

PE55138

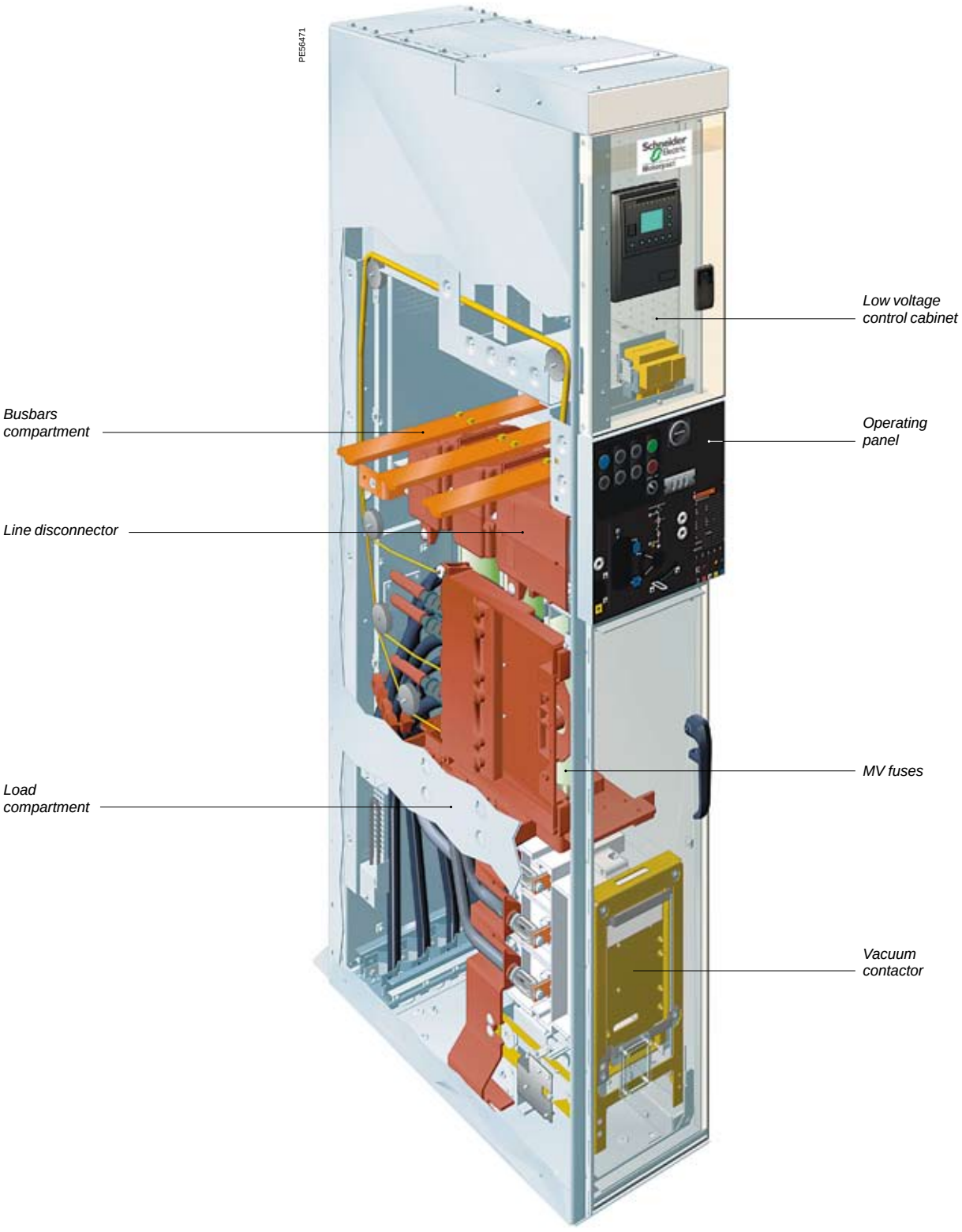
PE55139

PE55140

Functionalities provided

	TRe-1	TRe-2
Instantaneous readings Displays automatically updated meter values	■	■
Circuit summary Displays the RMS current 3-phase average (A), the real power (kW), the power factor, the circuit breaker status (if applicable), etc.	■	■
Load current summary Displays the current RMS value for each phase (A), for all circuits	■	■
Demand current summary Displays the average demand current value for each phase (A), for all circuits	■	■
Power summary Displays the present demand (kW), the peak demand (kW) and the times and dates of the records	■	■
Energy summary Displays the energy (kWh) the reactive energy (kvarh), and the times and dates of the records	■	■
Instantaneous readings, all devices Displays automatically updated meter values for all the communicating devices in the equipment		■
Basic historical data logging, energy and trending Displays automatically updated meter values for all the communicating devices in the equipment		■
Log displays Displays data as time curves, or tables		■
Export of data tables Allows data tables to be exported in a standard Windows format		■

Presentation



Presentation

Motorpact is composed of modular indoor single tier cubicles.
Each motor starter or transformer feeder consists of single or multiple section equipment close coupled to the main incoming switchgear.
Stand-alone motor starter equipment can be provided with an incoming cable cubicle.

Description of the basic cubicle

Each motor starter or transformer feeder consists of four parts separated by metal sheets or isolating parts and an operating panel (special sections are required for reduced voltage starters):

1 Line disconnector
A two position (closed or earthed) air break disconnector, safely isolates the load compartment from the busbars.

2 Busbars compartment
A horizontal main bus allows easy extension of the switchboard.

3 Load compartment
It includes:
- a removable vacuum contactor,
- 1 or 2 fuses per phase,
- a set of current sensors,
- a cable earthing switch (optional),
- cable connection facilities (top or bottom).

Optionally, the load compartment can contain a control power transformer (CPT), a voltage transformer (VT), a voltage presence indication system (VPIS) and a power factor correction capacitor.

4 Low voltage control cabinet
Adequate space is provided for all necessary protection and control devices such as Sepam protection relay, PowerMeter or Circuit Monitor metering unit, auxiliary relays, etc.
For access to the main busbars from the front of the switchboard, a removable panel at the bottom of the LV control cabinet is provided.

5 Operating panel
Contains all necessary devices to operate the line disconnector and the cable earthing switch.
Pushbuttons control the electrically held contactor and long life LED lights provide contactor status indication.

Technical characteristics

PE56472

Motor starter ratings

Installation	Indoor type
Maximum rated voltage	7.2 kV
Rated Insulation level:	
Impulse withstand voltage (1.2/50 µs, peak value)	60 kV
Power frequency withstand voltage (1 min)	20 kV
Maximum rated short time withstand current (busbars)	40 kA 3 s
	50 kA 2 s*
Rated frequency	50/60 Hz
Maximum busbars rating	2500 A
	3150 A*
Degree of protection	
Enclosure	IP3X, IP4X, IPX1, IPX2
Between compartments	IP2XC

** for stand-alone applications or when lined up with LF circuit breaker MCset switchgear*

Fused contactor ratings

Technology	Vacuum type
Rated operational current	200/400 A
Rated short circuit breaking capacity (HRC fuses)	50 kA
Rated switching frequency	1200/hour
Category of use	AC3 & AC4
Type of HRC coordination	Class C
Mechanism	Mechanically latched/ Electrically held
Electrical endurance (AC3)	250 000 operations
Mechanical life	
Mechanically latched type	250 000 operations
Electrically held type	2 500 000 operations

Internal arc withstand according to IEC 62271-200, app. A

Internal arc withstand (4 sides)	25 kA-1 s
	40 kA-0.5 s
	50 kA-0.25 s

Rated operational power

Values are given for combination with HRC fuses.

Network characteristics: power factor (cos φ) of 0.92 and efficiency 0.94.

Motor characteristics:	
Starting current	6 x In
Starting time	5 s
Number of starts per hour	6

	Rated voltage		
	3.3	5.5	6.6
Rated operational current: 200 A			
Motor power with 315 A single fuse (kW)	950	1500	1800
Transformer power with 315 A single fuse (kVA)	1000	1600	2000
Rated operational current: 400 A			
Motor power with 315 A single fuse (kW)	950	1600	1900
Motor power with 315 A double fuses (kW)	1900	3000	3800
Transformer power with 315 A double fuses (kVA)	1800	3000	3500

Operating conditions

Operating conditions

Normal operating conditions, according to IEC 60694 for indoor switchgear

■ Ambient air temperature:
□ less than or equal to 40°C,
□ less than or equal to 35°C on average over 24 hours,
□ greater or equal to – 5°C.
■ Altitude:
□ less than or equal to 1000 m,
□ above 1000 m, a derating coefficient is applied (please consult us).
■ Humidity:
□ average relative humidity over a 24 hour period, less than or equal to 95%,
□ average relative humidity over a 1 month period, less than or equal to 90%,
□ average vapor pressure over a 24 hour period, less than or equal to 2.2 kPa,
□ average vapor pressure over a 1 month period, less than or equal to 1.8 kPa.

Specific operating conditions (please consult us)

Motorpact has been developped to meet the following specific conditions:
■ earthquake withstand application (spectrum required),
■ temperature,
■ specific atmosphere,
■ marine applications.

Storage conditions

We recommend that the units are stored in their original packaging, in dry conditions sheltered from the sun and rain at a temperature between – 25°C and + 55°C.

Standards

Motorpact meets IEC standards	
IEC 60694	Common specifications for high-voltage switchgear and controlgear standards
IEC 62271-200	AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV (ex. IEC 60298)
IEC 60470	High voltage alternating current contactors and contactor based motorstarters
IEC 60282-1	High voltage fuses: limiting fuses
IEC 62271-102	Alternating current disconnectors and earthing switches (ex. IEC 60056)
IEC 60255	Electrical relays
IEC 60044-1	Instrument transformers - Part 1: current transformers
IEC 60044-2	Instrument transformers - Part 2: voltage transformers
IEC 60044-8	Instrument transformers - Part 8: low power current transducers
IEC 61958	High-voltage prefabricated switchgear and controlgear assemblies - Voltage presence indicating systems
IEC 60076-11	Auxiliary power transformers

Other specifications	
IBC 2000	International Building Code - Seismic qualification testing of nonstructural components

Specific applications

PE55541

Marine application

Derived from standard Motorpact, a Marine version has been developed to meet specific conditions when used on ships, offshore platforms,…:

- vibrations/shocks,
- steepness,
- etc.

Motorpact is particularly adapted and its characteristics meet Marine requirements:

- compartmented cubicle (LSC2A type),
- front access,
- withdrawable circuit breaker,
- Sepam protection and control chain,
- internal arc withstand,
- thermal diagnosis.

E74225

Certifications

Motorpact Marine is approved by:

- Lloyds Register (LR),
- Det Norske Veritas (DNV),
- Bureau Veritas (BV),
- Germanischer Lloyd (GL),
- American Bureau of Shipping (ABS).

LR Type Approval Certificate

DNV

BUREAU VERITAS

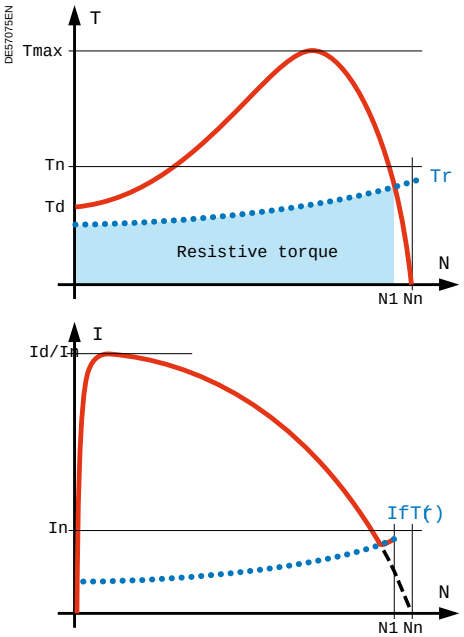
Germanischer Lloyd

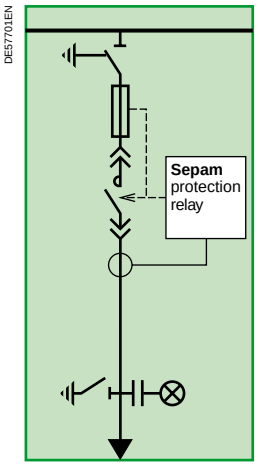
American Bureau of Shipping

MT20073

Motorpact range

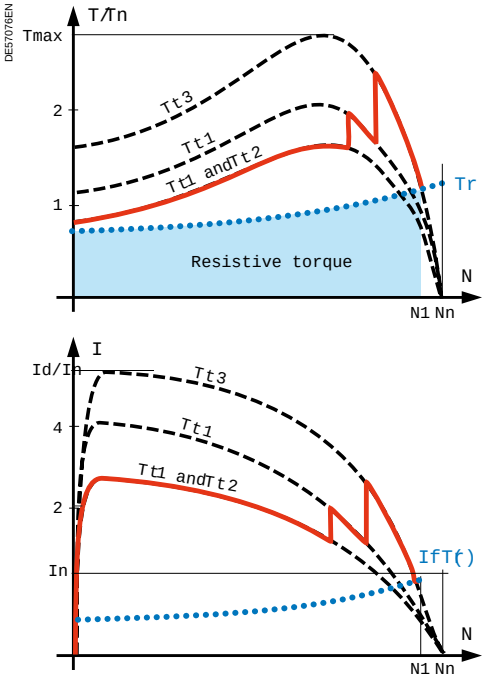
FVNR: full voltage non reversing asynchronous* motor starter

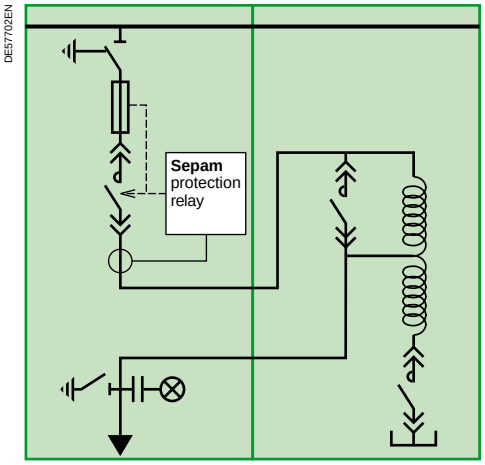




Full Voltage Non Reversing motor starter
A simple and reliable solution, that provides the maximum starting torque allowed by the motor, suitable for most applications.
Since it draws high inrush current (typically 600% of full load motor current), it can be used when there are no motor, machine or network restrictions.
For the following applications reduced voltage starting should be used:
■ when maximum starting torque can result in a sudden start of the machine and can cause undesirable mechanical constraints.
■ when high inrush current during starting can cause the system line voltage to drop to unacceptable levels and result in potential equipment damage or can cause network instability.

RVAT: auto-transformer asynchronous* motor starter



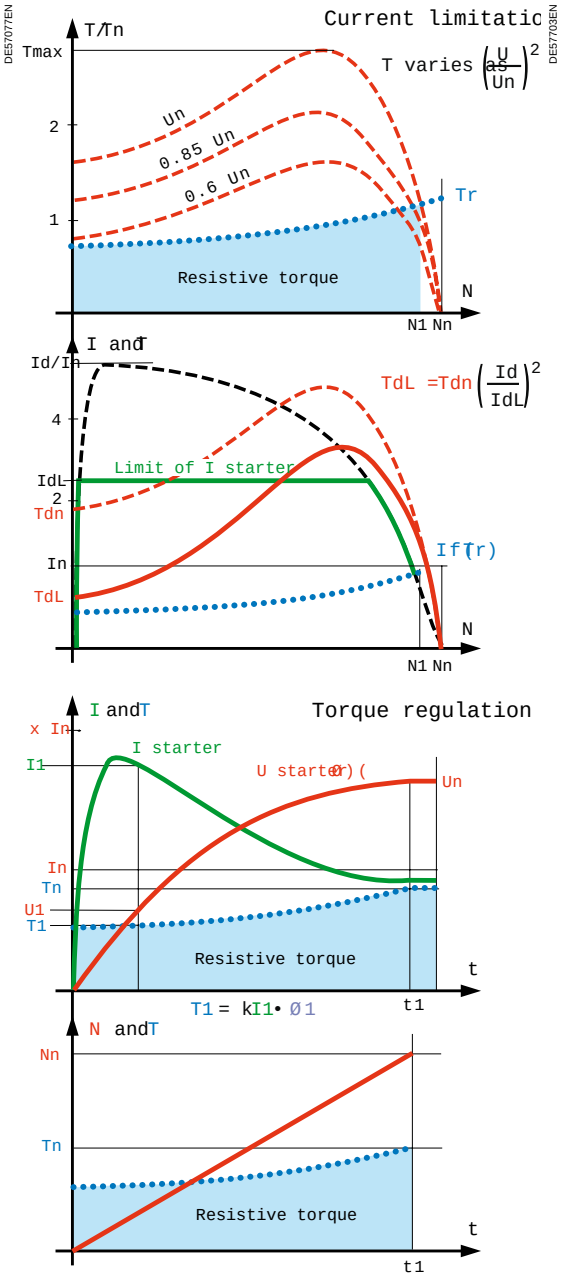


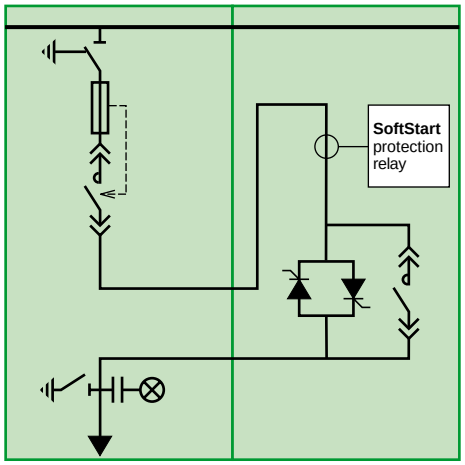
Reduced Voltage Auto-Transformer motor starter
It is used when the network cannot withstand high inrush current.
An auto-transformer motor starter provides reduced voltage to the motor terminals during starting, with a three phase auto-transformer.
It reduces the line current and provides the right starting torque.

** For synchronous motors, please consult us*
For selection of motor starter type, see the Application guide ref. AMTED303042EN

Motorpact range

RVSS: SoftStart asynchronous* motor starter





Reduced Voltage SoftStart motor starter
SoftStart motor starter provides smooth, stepless acceleration and deceleration regardless of the load.
This starting method lowers the starting current of the motor, reduces electrical stresses on the network and the motor.
It reduces peak starting torque stresses on both the motor and mechanical load components, thereby providing longer service life and less downtime.

** For synchronous motors, please consult us*
For selection of motor starter type, see the Application guide ref. AMTED303042EN

Motorpact range

Transformer feeder

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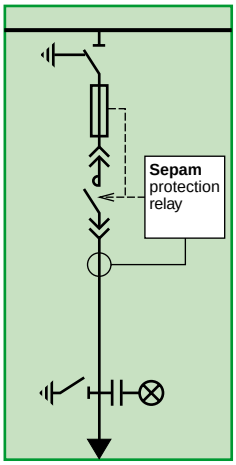
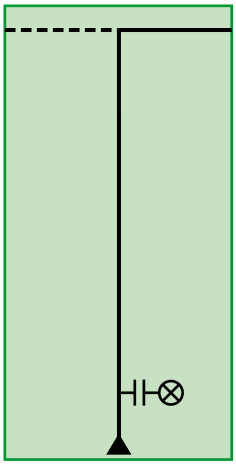


Transformer feeder is a cost-effective solution to include auxiliary transformer feeder in a Motorpact assembly. It can be used as a fused contactor feeder with Sepam transformer relay, or as a fused switch.
This solution for a transformer feeder within a motor starter assembly, provides the operator consistency in the operation of the equipment, as well as providing standardisation of features and controls in the Motorpact range.

Incoming cubicle for stand-alone application

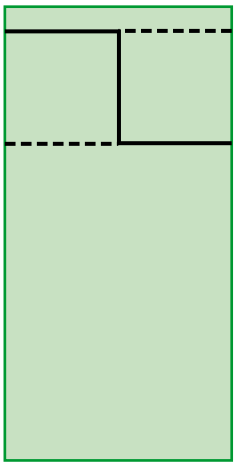
DES7704



An auxiliary cubicle for incoming cable connections for standalone motor control applications.
Available up to 3150 A.
Bottom cable entry is available in the 500 mm cubicle.
Busduct, top and bottom cable entry is available in the 750 mm cubicle.
Optional voltage presence indicator system (VPIS).

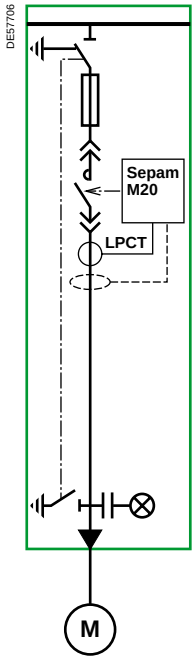
MCset transition cubicle for lined up application

DES7705



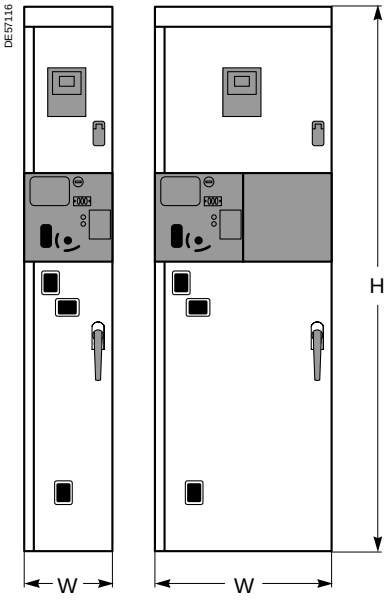
An auxiliary cubicle to allow transition to the MCset switchgear, at either end.
Available up to 4000 A.

FVNR: full voltage non reversing asynchronous motor starter



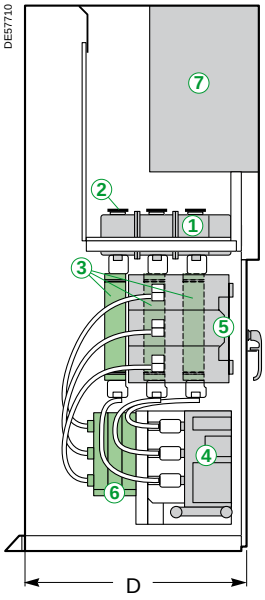
Front view

FVNR1 *FVNR3*



Side view

FVNR1 and FVNR3



MV compartment
1 Line disconnector
2 Busbars
3 Fuses
4 Contactor
5 Earthing switch
6 Current sensors LPCT, current transformer and earth fault sensor

LV control cabinet
7 LV protection, measurement and control devices

Characteristics

		FVNR1	FVNR3
Maximum rated voltage		7.2 kV	
Maximum power at 6.6 kV (p.f.: 0.88, η: 0.95		3800 kW	
Impulse withstand voltage (1.2/50 µs, peak value)		60 kV	
Power frequency withstand voltage (1 min)		20 kV	
Rated short time withstand current (busbars)		25 kA 3 s	
		31.5 kA 3 s	
		40 kA 3 s	
		50 kA 2 s*	
Rated frequency		50/60 Hz	
Rated operational current		200/400 A	
Busbars ratings		630 A	
		1250 A	
		2500 A	
		3150 A*	
Category of use		AC3/AC4	
Cable connections		Single or three core	
		Maximum 1 x 240 mm^2 or 2 x 120 mm^2	
		Bottom or top	
Dimensions	H	2300 mm	2300 mm
	W	375 mm	750 mm
	D	950 mm	950 mm
Approximate weight		475 kg	650 kg

** For stand-alone applications or when lined up with LF circuit breaker MCset switchgear*

FVNR: full voltage non reversing asynchronous motor starter

Composition of FVNR motor starter

Basic equipment

Cubicle

- 1 enclosure (standard IP3X)
- 1 line disconnector
- 1 electrically held vacuum contactor
- 3 or 6 HRC fuses
- 1 set of busbars
- 1 three core LPCT
- auxiliary contacts
- provision for padlocks
- 1 position contactor indicator window

Low voltage control

- 1 Sepam M20 motor protection relay
- "Start" & "Stop" pushbuttons
- "Run" & "Stopped" pilot lights

Options and accessories

Starter options

- thermal diagnosis system
- internal arc withstand
- cable earthing switch including:
  - mechanical position indicator
  - auxiliary contacts
  - padlock provision
- blown fuse indicator
- IP4X or IPX1 enclosure
- one fused 3-phase voltage transformer
- power factor correction capacitor (FVNR3)
- mechanically latched vacuum contactor (includes release coil)
- 1 disconnector/ load compartment back light
- key interlocks
- encapsulated busbars
- 1 fused control power transformer (CPT)
- additional CT's or ZSCT (zero sequence current transformer)
- 1 set of 3 surge arrestors
- voltage presence indicator system (VPIS)
- heating resistor
- mechanical operation counter
- running time meter

Control options

- Sepam series 40 or series 80 protection relay
- Transparent Ready option
- 1 Sepam 100 MI control and indication
- local remote switch (not needed in case of Sepam 100MI)

Sepam accessories

- additional logic I/O module
- Modbus communication interface
- motor temperature sensor acquisition module
- analog output module

Padlocks and key interlocks

	Padlocks	Key interlocks
Disconnector	C + O	O or O & C
Cable earthing switch	C + O	O or C

Operation and interlocking

The disconnector mechanism incorporates the necessary interlocks (mechanical and/or electrical) to prevent access to the load compartment with the contactor energized. All interlocking requires three simultaneous operations to defeat any function without the destruction of parts.

Interlocking:

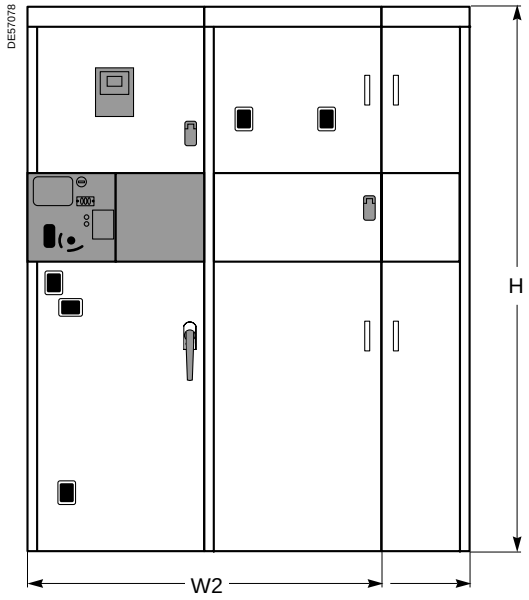
- prevents disconnector closure (normal operations) if:
  - the contactor is closed,
  - the load compartment door is open,
  - the contactor is not in the fully connected position,
  - the cable earthing switch is closed, if so equipped.
- prevents closure of the contactor if the Blown Fuse Indication system has not been reset.
- prevents unlatching the load compartment door when the disconnector is closed.
- prevents access to the contactor/cable compartment unless:
  - the contactor is open and the disconnector is earthed,
  - the earthing switch is closed, if so equipped (Provision to operate the earthing switch with door open for cable testing is provided),
  - the operating handle has been removed.
- allows for a test position which meets the following criteria:
  - the front door has been opened for access,
  - the disconnector is open and earthed and can not be closed,
  - the contactor is in the fully connected position and can be operated,
  - the control power transformer has been isolated from the test control power.

All interlocks do not require adjustments over the life of the equipment.

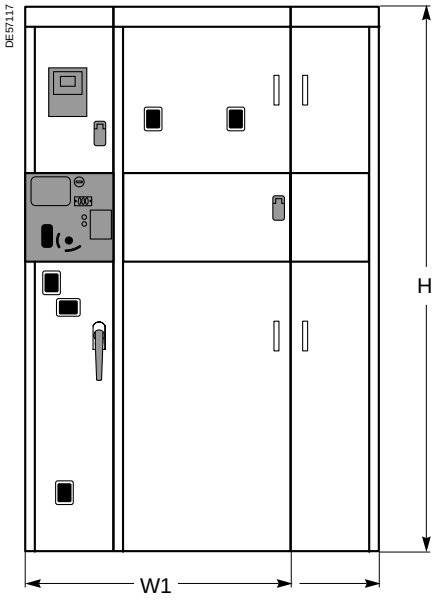
RVAT: auto-transformer asynchronous motor starter

Front view

Main cubicle *Auto-transformer module*

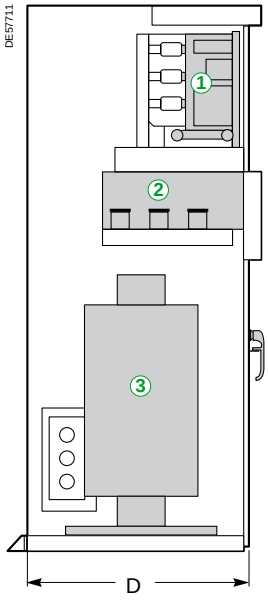


Main cubicle *Auto-transformer module*

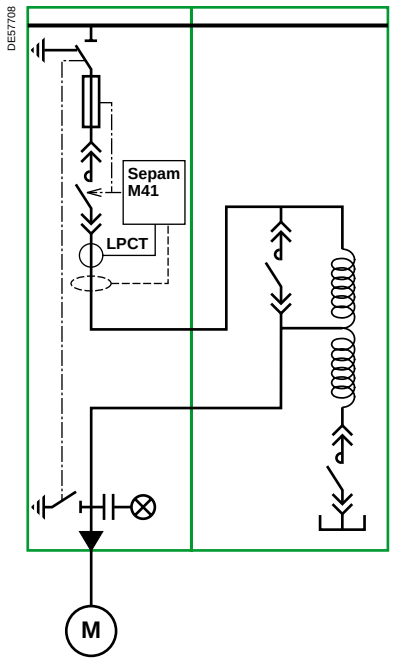


Side view

Auto-transformer module



1 Run and start vacuum contactor
2 Busbars
3 Auto-transformer



Characteristics

		ATM1	ATM2
Maximum motor power		**440 kW**	**3800 kW**
Dimensions	H	2300 mm	2300 mm
	W1	1500 mm	1875 mm
	W2 with capacitor module	1875 mm	2250 mm
	D	950 mm	950 mm
Approximate weight (Auto-transformer weight to be added)		1200 kg	1360 kg

The auto-transformer is designed according to the motor requirements:

Nominal power	
Service voltage	
Nominal current	
Frequency	
Starting current	
Starting time (motor)	
Starting time (motor + auto-transformer)	
Number of starts/hour	
Number of consecutive starts	

RVAT: auto-transformer asynchronous motor starter

Composition of RVAT motor starter

The RVAT motor starter is composed of a main cubicle similar to FVNR unit and auto-transformer module.

Basic equipment

Main cubicle

- 1 enclosure (standard IP3X)
- 1 line disconnector
- 1 electrically held vacuum contactor
- 3 or 6 HRC fuses
- 1 set of busbars
- 1 three core LPCT
- auxiliary contacts
- provision for padlocks
- 1 position contactor indicator window

Auto-transformer module

- 1 enclosure (standard IP3X)
- 1 electrically held vacuum contactor (Run contactor)
- 1 vacuum contactor, mechanically interlocked with the Run contactor (Start contactor)
- 1 auto-transformer
- provision for LPCT (true current measurement)

Low voltage control

- 1 Sepam M41 protection relay including starting automation
- "Start" & "Stop" pushbuttons
- "Run" & "Stopped" pilot lights

Options and accessories

Starter options

- thermal diagnosis system
- internal arc withstand
- cable earthing switch including:
  - mechanical position indicator
  - auxiliary contacts
  - padlock provision
- blown fuse indicator
- IP4X or IPX1 enclosure
- power factor correction capacitor (FVNR3)
- mechanically latched vacuum contactor (includes release coil)
- 1 disconnector/ load compartment back light
- key interlocks
- encapsulated busbars
- 1 fused control power transformer (CPT)
- additional CT's or ZSCT (zero sequence current transformer)
- 1 set of 3 surge arrestors
- voltage presence indicator system (VPIS)
- heating resistor
- mechanical operation counter
- running time meter
- contactor position indicator windows for auto-transformer cubicle

Control options

- Sepam series 40 or series 80 protection relay
- Transparent Ready option
- 1 Sepam 100 MI control and indication
- local remote switch (not needed in case of Sepam 100MI)

Sepam accessories

- additional logic I/O module
- Modbus communication interface
- motor temperature sensor acquisition module
- analog output module

Padlocks and key interlocks

	Padlocks	Key interlocks
Disconnector	C + O	O or O & C
Cable earthing switch	C + O	O or C
Run contactor		O
Start contactor		C

Operation and interlocking

Main cubicle: see FVNR cubicle

Auto-transformer module

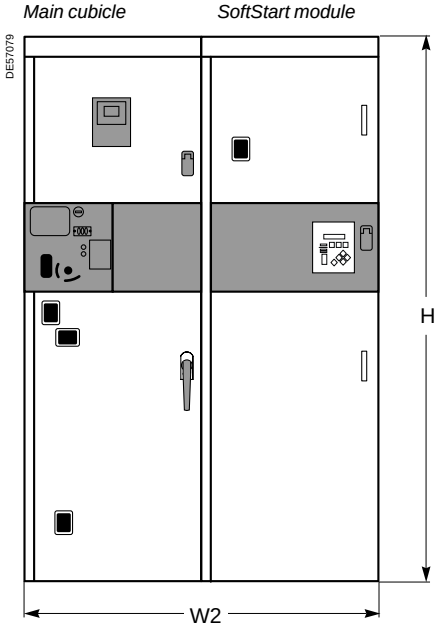
The disconnector mechanism in the main cubicle incorporates the necessary interlocks to prevent access to the load compartment with the contactor energized.
The disconnector mechanism is key interlocked with the auto-transformer module to prevent access to the medium voltage components:

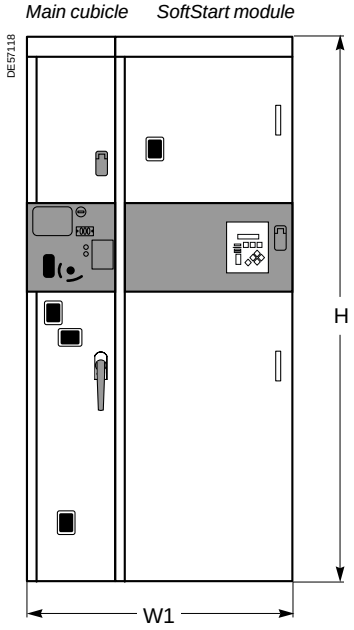
- auto-transformer,
- start contactor,
- run contactor.

The start and run contactors are mechanically and electrically interlocked to prevent simultaneous closure.
On auto-transformer modules the doors are interlocked to prevent closing the disconnector without all of them being closed.
Power to the Start and Run contactors comes from the adjacent main cubicle.
The power from the Run contactor is then routed back to the load terminal box in the main cubicle.
The auto-transformer is of a roll in design such that it can be handled separately making it easier to handle, position and install the cubicle.
The module is available with a main bus compartment to allow easy extension to the switchboard. Extension may be an FVNR, RVSS or another RVAT unit.

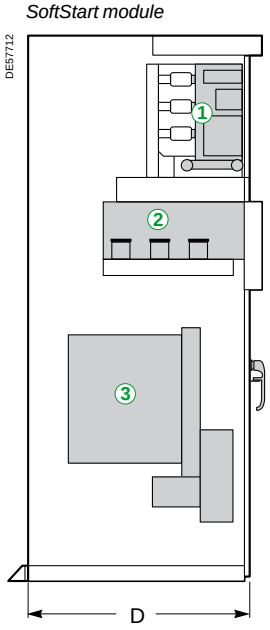
RVSS: SoftStart asynchronous motor starter

Front view

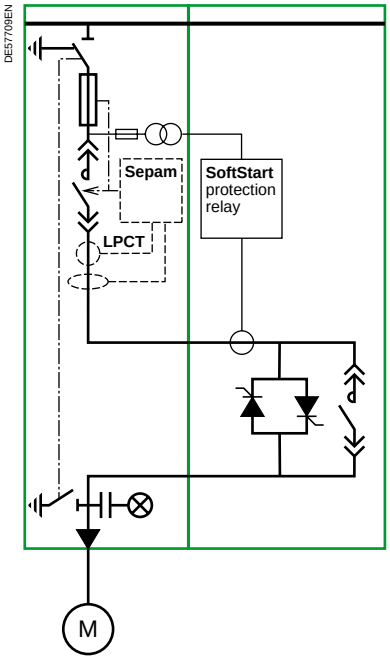




Side view



1 By-pass vacuum contactor
2 Busbars
3 SoftStart power stack



Characteristics

Rated current		**200/400 A**
Dimensions	H	2300 mm
	W1	1125 mm
	W2 with capacitor module	1500 mm
	D	950 mm
Approximate weight		1095 kg

RVSS: SoftStart asynchronous motor starter

Composition of RVSS motor starter

The RVSS motor starter is composed of a main cubicle identical to FVNR unit and SoftStart module.

Basic equipment

Main cubicle

- 1 enclosure (standard IP3X)
- 1 line disconnector
- 1 electrically held vacuum contactor
- 3 or 6 HRC fuses
- 1 set of busbars
- auxiliary contacts
- provision for padlocks
- 1 position contactor indicator window
- 1 voltage transformer
- 1 fused control power transformer 750 VA

SoftStart module

- 1 enclosure (standard IP3X)
- 1 electrically held vacuum contactor (by-pass contactor)
- 1 SCR power module
- voltage measurement
- 1 set of current sensors
- 1 microprocessor-based protection and control system
- motor temperature sensor inputs (option)

Low voltage control

- "Start" & "Stop" pushbuttons
- "Run" & "Stopped" pilot lights

Options and accessories

Module options

- thermal diagnosis system
- internal arc withstand
- cable earthing switch including:
  - mechanical position indicator
  - auxiliary contacts
  - padlock provision
- 1 three core LPCT
- blown fuse indicator
- IP4X or IPX1 enclosure
- power factor correction capacitor (FVNR3)
- mechanically latched vacuum contactor (includes release coil)
- 1 disconnector/ load compartment back light
- key interlocks
- encapsulated busbars
- additional CT's or ZSCT (zero sequence current transformer)
- 1 set of 3 surge arrestors
- voltage presence indicator system (VPIS)
- heating resistor
- mechanical operation counter
- running time meter

Control options

- Sepam series 20, series 40 or series 80 protection relay
- Transparent Ready option
- 1 Sepam 100 MI control and indication
- local remote switch (not needed in case of Sepam 100MI)

Sepam accessories

- additional logic I/O module
- Modbus communication interface
- motor temperature sensor acquisition module
- analog output module

Padlocks and key interlocks

	Padlocks	Key interlocks
Disconnector	C + O	O or O & C
Cable earthing switch	C + O	O or C
By-pass contactor		O

Operation and interlocking

Main cubicle: see FVNR cubicle

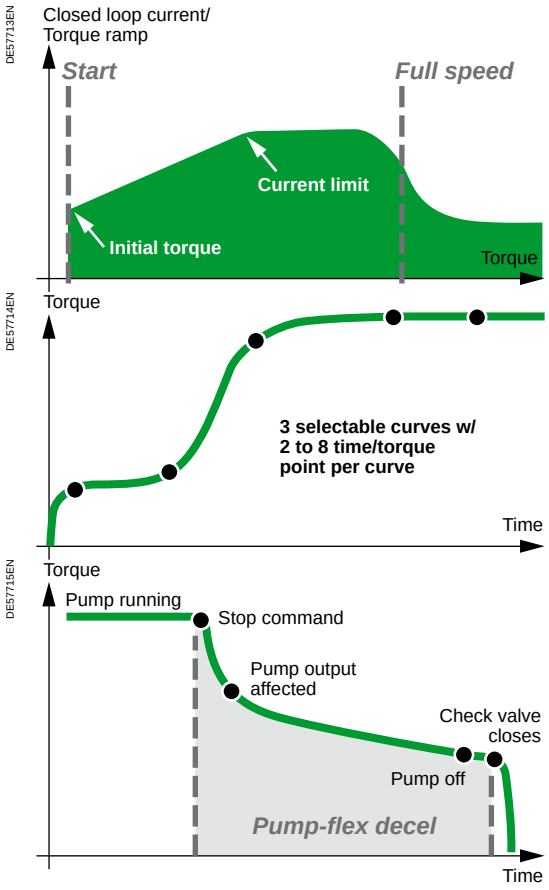
SoftStart module

The disconnector mechanism in the main cubicle incorporates the necessary interlocks to prevent access to the load compartment with the contactor energized.
The disconnector mechanism is key interlocked with the SoftStart module to prevent access to the medium voltage components:

- SoftStart,
- by-pass contactor,
- communication board.

On SoftStart module the doors are interlocked to prevent locking the unit without all of them being closed.
Power to the SoftStart module comes from the adjacent main cubicle.
When the motor has started, the by-pass contactor is closed.
The by-pass contactor can be opened to provide a soft deceleration of the motor.

RVSS: SoftStart asynchronous motor starter



Pumps, fans, blowers and conveyors

■ **Closed Loop Torque**
□ uses PID (proportional, integral, derivative) algorithms
□ ideal for deep well pumps
□ ideal for systems where loads change from start to start.
■ **Linear Speed Ramping**
□ achieved by adding tachometer feedback signal from the motor.

Custom acceleration curves

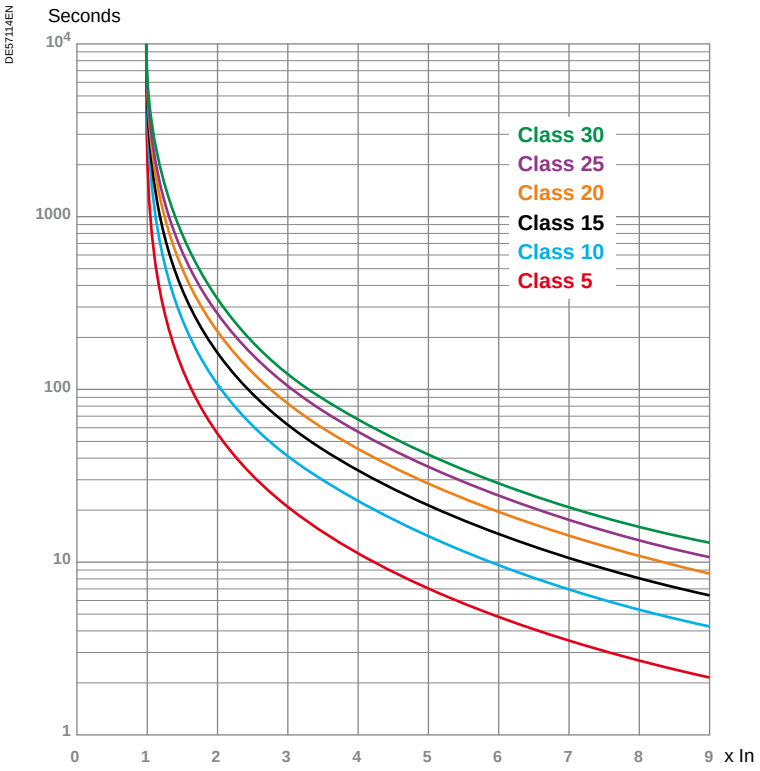
■ Programmed to match pump and hydraulic conditions.
■ Up to eight time and torque points for smooth acceleration of pumps without surges or undue motor thermal stress.
■ Three selectable and programmable custom curves for changing load/pump conditions or different processes.

Pump-decel

■ Gradual reduction in output torque of the pump motor when a stop signal is initiated.
■ When the motor output reaches a point where the check valve can be safely and gently closed, the decel circuit automatically turns off.
■ **Eliminate damage due to "water hammer"**
■ With DOL motor starters, torque is lost instantly when the starter is turned off.
□ fluid flowing through the system, and associated kinetic energy, immediately reverses. To prevent reverse flow, a check valve closes trapping kinetic energy in the piping system and creating a shock wave (water hammer).
□ gradual reduction in motor torque using decel control dissipates the pump output pressure slowly during the stopping process. Check valves close gently and the other system components (pipes, valves, flanges, couplings and hangers) are not subjected to the shock.

Process machinery

■ **Jog** function can be used to apply just enough voltage/torque to rotate the motor shaft without accelerating to full speed.
■ **Dual ramps** allow for different load conditions and ramping requirements.
□ programmable overload class 5 - 30
□ as an example class 30 for starting and class 10 for running.



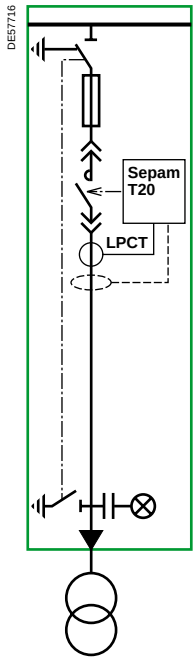
RVSS: SoftStart asynchronous motor starter

PE55174

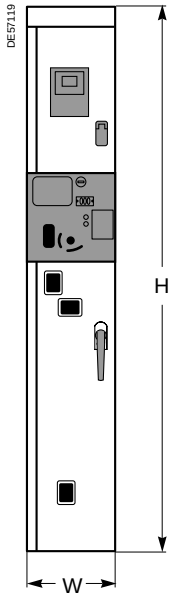
Main features

Characteristics		
Overload capacity	125% - continuous 500% - 60 seconds 600% - 30 seconds 850% - 1 cycle (internal electronic shear pin)	
Frequency	50 or 60 Hz ± 2 Hz (hardware selectable)	
Power circuit	6, 12 or 18 SCRs	
SCR PIV rating	3.3 kV - 13000 6.6 kV - 19500	
Phase insensitivity	User selectable - Phase sequence detection	
Transient voltage protection	RC snubber dv/dt networks (1 per SCR pair)	
Control power	2 or 3 wire 110 Vac CPTs are supplied on all standard units	
Auxiliary contacts	Multiple changeover contacts rated 5 A - 250 Vac max. 8 fully programmable relays (including fail-safe operation) 5 dedicated relays (fault, at-speed, etc.)	
Motor protection		
Two stage electronic Overload curves	Start: Run:	Class 5 to 30 Class 5 to 30 (when at speed detected)
Overload reset	Manual (Default) or automatic	
Retentive thermal memory	Overload circuit retains thermal condition of the motor witout control power Real time clock adjusts for “off time”.	
Dynamic reset capacity	No overload reset until thermal capacity is sufficient to restart motor Starter monitors, learns and retains thermal data from successful starts	
Phase current imbalance protection	Imbalance trip level: Imbalance trip delay:	5-30% current between any 2 phases 1-20 seconds
Overcurrent protection (Electronic shear pin)	Trip level: Trip delay:	100-300% In 1-20 seconds
Load loss protection	Undercurrent trip level: Undercurrent trip delay:	10-90% In 1-60 seconds
Coast down (Back spin) Lockout timer	Coast down time:	1-60 minutes
Starts per hour lockout timer	Range: Time between starts:	1-6 successful starts per hour 1-60 minutes
Programmable outputs		
Type/Rating	Changeover contacts:	5 A 240 Vac
Run indication	Programmable	
At speed indication	Programmable	
Acceleration adjustments	Programmable ramp types: Starting torque: Ramp time: Current limit:	Voltage or current ramp (VR or CR) 0-100% of line voltage (VR) or 0-600% of motor In (CR) 1 – 120 seconds 200 – 600% (VR or CR)
Dual ramp settings	4 options: Dual ramp control :	VR1+VR2; VR1+CR2; CR1+CR2; CR1+VR2 Ramp 1 = Default Ramp 2 = Selectable via dry contact
Deceleration adjustments	Begin decel level: Stop level: Decel time:	0-100%Un 0-100% less than begin decel level 1 – 60 seconds
Jog settings	Voltage jog:	5–75%
Kick start settings	Kick voltage: Kick time:	10–100% or off 0.1–2 seconds
Fault display	Shorted SCR, phase loss, shunt trip, phase imbalance trip, overload, overtemp, overcurrent, short circuit, load loss, undervoltage or any trip	
Lockout display	Coast down time, starts per hour, time between starts, and any lockout	
Event history		
Up to 60 events	Data includes cause of event, time, date, voltage, power factor, and current for each phase, and ground fault current at time of event	
Metering functions		
Motor load	Percent of In	
Current data	A, B, C phase current, average current, ground fault (option)	
Thermal data	Remaining thermal register; thermal capacity to start	
Start data	Average start time and start current, measured capacity to start, time since last start	
Resistance temperature detector data	Temperature readings from up to 12 RTDs (6 stators)	
Voltage metering	kW, kVAR, PF, kWh	
Serial communications		
Protocol	Modbus® RTU	
Signal	RS-485, RS-422, or RS-232	
Network	Up to 247 devices per node	
Functionality	Full operation, status view, and programming via communications port	

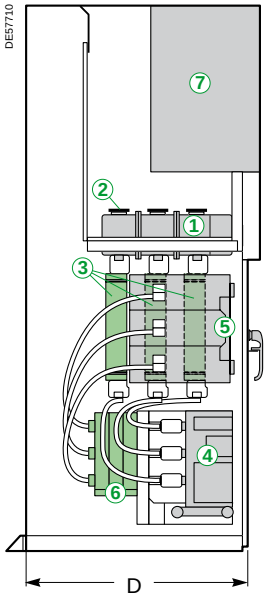
Transformer feeder



Front view



Side view



MV compartment
1 Line disconnector
2 Busbars
3 Fuses
4 Contactor
5 Earthing switch
6 Current sensors LPCT

LV control cabinet
7 LV protection, measurement and control devices

Characteristics

		Transformer feeder
Maximum rated voltage		7.2 kV
Impulse withstand voltage (1.2/50 µs, peak value)		60 kV
Power frequency withstand voltage (1 min)		20 kV
Rated short time withstand current (busbars)		25 kA 3 s
		31.5 kA 3 s
		40 kA 3 s
		50 kA 2 s*
Rated frequency		50/60 Hz
Rated operational current		200/400 A
Busbars rating		630 A
		1250 A
		2500 A
		3150 A*
Dimensions	H	2300 mm
	W	375 mm
	D	950 mm
Approximate weight		475 kg

** For stand-alone applications or when lined up with LF circuit breaker MCset switchgear*

Transformer feeder

Composition of the transformer feeder

Basic equipment

Cubicle

- 1 enclosure (standard IP3X)
- 1 line disconnector
- 1 electrically held vacuum contactor
- 3 or 6 HRC fuses
- 1 set of busbars
- 1 three core LPCT
- auxiliary contacts
- provision for padlocks
- 1 position contactor indicator window

Low voltage control

- 1 Sepam T20 transformer protection relay
- "Start" & "Stop" pushbuttons
- "Run" & "Stopped" pilot lights

Options and accessories

Feeder options

- thermal diagnosis system
- internal arc withstand
- cable earthing switch including:
- mechanical position indicator
- auxiliary contacts
- padlock provision
- blown fuse indicator
- IP4X or IPX1 enclosure
- mechanically latched vacuum contactor (includes release coil)
- 1 disconnector/ load compartment back light
- key interlocks
- encapsulated busbars
- 1 fused control power transformer (CPT)
- additional CT's or ZSCT (zero sequence current transformer)
- 1 set of 3 surge arrestors
- voltage presence indicator system (VPIS)
- heating resistor
- mechanical operation counter
- running time meter

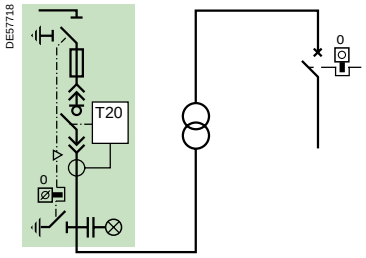
Control options

- fuse protection without protective relay
- Sepam series 40 or series 80 protection relay
- Transparent Ready option
- 1 Sepam 100 MI control and indication
- local remote switch (not needed in case of Sepam 100MI)

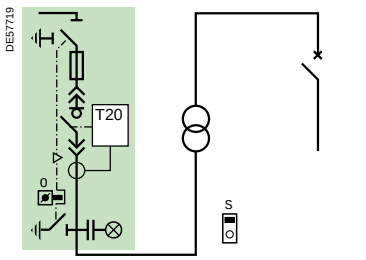
Sepam accessories

- additional logic I/O module
- Modbus communication interface
- motor temperature sensor acquisition module
- analog output module

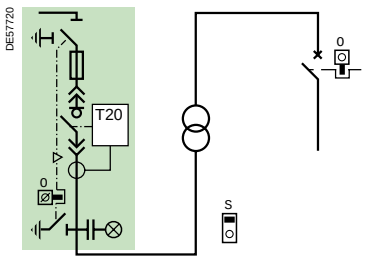
A1 type



C1 type



C4 type



Operation and interlocking

See FVNR cubicle.

Basic transformer key interlocks

A1 type

To prevent closing the earthing switch on a transformer feeder unless the LV circuit breaker has been opened first and locked in the open or disconnected position.

C1 type

To prevent access to the transformer if the earthing switch of the feeder has not been closed first.

C4 Type

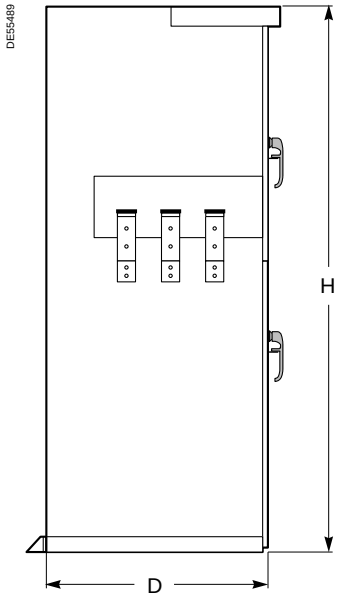
To prevent closing the earthing switch on a transformer feeder unless the LV circuit breaker has been opened first and locked in the open or disconnected position and to prevent access to the transformer if the earthing switch of the feeder has not been closed first.

Padlocks and key interlocks

	Padlocks	Key interlocks
Disconnector	C + O	O or O & C
Cable earthing switch	C + O	O or C

Incoming cubicle
Transition to MCset functional units

Side view



Incoming cubicle

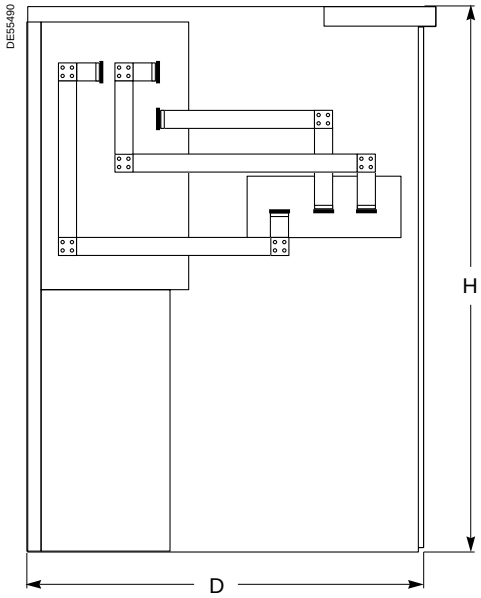
Composition

Basic equipment	Options
■ 1 enclosure (standard IP3X)	■ internal arc withstand
■ 1 set of busbars	■ IP4X or IPX1 enclosure
■ provision for cable connections	■ encapsulated busbars
□ single or three core	
□ bottom or top connection	

Characteristics

		Incoming cubicle	
		500	**750**
Maximum rated voltage		7.2 kV	7.2 kV
Impulse withstand voltage (1.2/50 µs, peak value)		60 kV	60 kV
Power frequency withstand voltage (1 min)		20 kV	20 kV
Busbars ratings		630 A	630 A
		1250 A	1250 A
		2500 A	2500 A
		3150 A	3150 A
Cables		Bottom	Top or bottom
	Single core	6 x 400 mm^2	6 x 400 mm^2
		4 x 500 mm^2	4 x 500 mm^2
	Three core	6 x 240 mm^2	6 x 240 mm^2
Busducts		–	Top
Dimensions	H	2300 mm	2300 mm
	W	500 mm	750 mm
	D	950 mm	950 mm
Approximate weight		350 kg	900 kg

Side view



Transition to MCset functional units

Composition

Basic equipment	Options
■ 1 enclosure (standard IP3X)	■ internal arc withstand
■ 1 set of busbars in separate compartment	■ IP4X or IPX1 enclosure
■ 1 removable front panel	■ encapsulated busbars

Characteristics

		Transition cubicle to MCset
Maximum rated voltage		7.2 kV
Impulse withstand voltage (1.2/50 µs, peak value)		60 kV
Power frequency withstand voltage (1 min)		20 kV
Busbars ratings		630 A
		1250 A
		2500 A
		3150 A
Dimensions	H	2300 mm
	W	375 mm
	D	1550 mm
Approximate weight		*Consult us*

MCset functional unit

The MCset cubicle

The cubicle is of LSC2B (Loss of Service Continuity Category) type as defined by IEC standard 62271-200, in other words the medium voltage parts are compartmented using metal partitions (PM class) which are connected to earth and which separate:

- the busbars
- the withdrawable part (circuit breaker, fuse-contactor, disconnector truck or earthing truck)
- MV connections, earthing switch, current sensors and voltage transformers as required.

MCset guarantees a high level of protection of people; when a compartment containing a main circuit is open, the other compartments and/or functional units may remain energised.

The low voltage auxiliaries and monitoring unit are in a control cabinet separated from the medium voltage section. Four basic cubicle layouts are offered:

- incomer or feeder **AD**
- line up bussection **CL - GL**
- busbar metering and earthing **TT**
- switch-fuse feeder **DI**

AD and CL cubicles have withdrawable switchgear.

Make-up a Motorpact-MCset switchboard

MCset switchboard is made-up of several interconnected functional units.

By using a transition functional unit, it's easy to connect a MCset switchboard with a Motorpact switchboard.

For details, see MCset catalogue ref. DEAI02.

PE56473

Electrical characteristics

The values below are given for normal operating conditions as defined in IEC 62271-200 and IEC 60694.

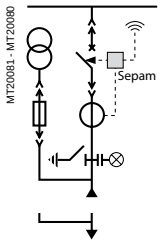
Rated voltage (kV)				
			7.2	**12**
Rated insulation level				
Power frequency withstand voltage 50 Hz - 1 min (rms kV)			20	28
Lightning impulse withstand voltage 1.2/50 µs (kV peak)			60	75
Nominal current and maximum short time withstand current (1)				
Functional unit with circuit breaker				
Short time withstand current	Ith max.	(kA/3 s)	25	25
			31.5	31.5
			40	40
		(kA/3 s) (7)	50	50
Rated current	In max. busbar	(A)	4000	4000
Rated current	In CB	(A)	1250	1250
			2500	2500
			3150	3150
			4000 (2) (5)	4000 (2) (5)
Functional unit with fuse-contactor (3)				
Short time withstand current	Ith max.	(kA)	50 (4)	50 (4) (6)
Rated current	In max.	(A)	250	200 (6)
Functional unit with switch-fuse (DI cubicle)				
Short time withstand current	Ith max.	(kA)	50 (4)	50 (4)
Rated current	In max.	(A)	200	200
Internal arc withstand (maximum value)				
		(kA/1 s)	50	50

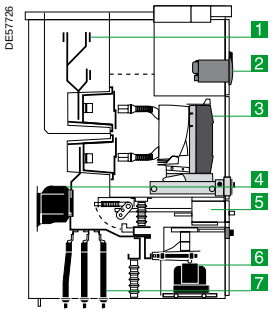
(1) For functional units equipped with circuit breakers or fuse-contactors, the breaking capacity is equal to the short time withstand current. In all cases, the device peak making capacity is equal to 2.5 times the short time withstand current.
(2) With fan.
(3) Lightning impulse dielectric withstand voltage = 60 kV peak.
(4) Limited by fuses.
(5) With LF circuit breaker (with Evolis circuit breaker, consult us).
(6) With Rollarc contactor.
(7) Limited to 1 s for In circuit breaker: 1250 A.

MCset functional unit

The MCset range includes 13 functional units, based on 4 functions.

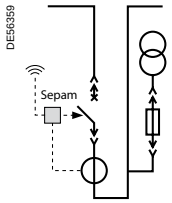
Incomer/Feeder

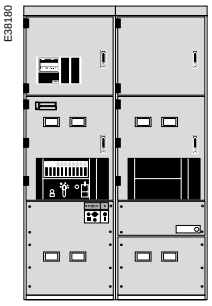


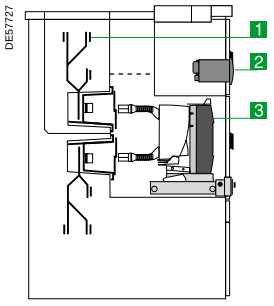


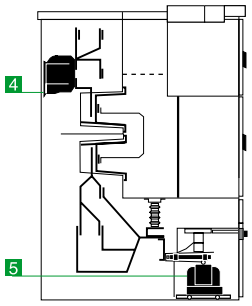
1 Busbar
2 LV control cabinet
3 Withdrawable part
4 Current sensors
5 Earthing switch
6 Voltage transformers
7 MV connections

Line-up bussectionning



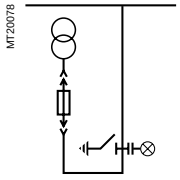


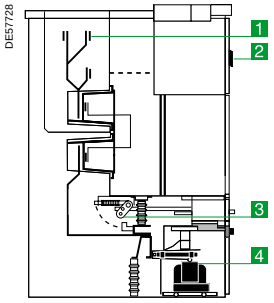




1 Busbar
2 LV control cabinet
3 Withdrawable part
4 Current sensors
5 Voltage transformers

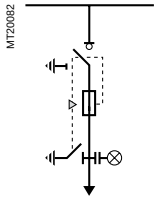
Metering and busbar earthing

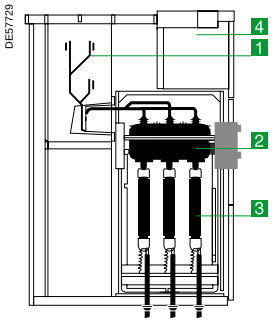




1 Busbar
2 LV control cabinet
3 Earthing switch
4 Voltage transformers

Switch fuse feeder



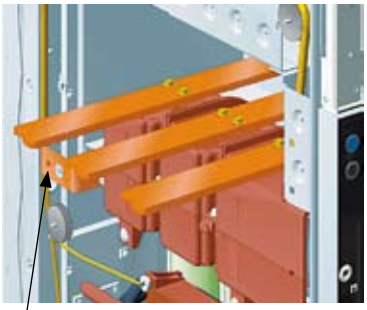


1 Busbar
2 Earthing switch
3 MV fuses
4 LV control cabinet

Enclosures

PE56474

PE55146



Earthing conductor interconnection

General characteristics

Motorpact is composed of modular cubicles, single tiers, indoor construction.
Each transformer or motor starter consists in a single or multiple section line up close coupled to the main incomer switchgear.

Degree of protection

- IP3X outside the enclosure (optional 4X).
- IP2XC inside the enclosure.
- IPX1 is optional.

Tunnel

A tunnel of 457 mm is installed:

- when the rating current of the busbars is higher than 2500 A,
- when the cubicle is internal arc type and the ceiling is lower than 4 m.

Anti corrosion protection and finishing

To ensure that the equipment performs under severe climatic it is finished as follows:
1 – all non-painted steel parts are zinc plated.
2 – all painted steel parts are cleaned and a zinc-phosphate pre-treatment applied prior to paint application.
3 – paint colour is RAL9002 white frosted TGIC polyester powder, applied electrostatically through air. Following paint application, parts are baked to produce a hard durable finish. The average thickness of the paint film is 50 microns.
Paint film is uniform in color and free from blisters, sags, flaking and peeling.
4 – adequacy of paint finish to inhibit the buildup of rust on ferrous metal materials are periodically tested and evaluated.

Earthing conductor

Copper earthing conductor is continuous and extends from one end of the motor starter switchboard to the other through each vertical section.
Each section is supplied with an internal earthing conductor of 6 x 50 mm.

The earthing conductor connections are designed for easy future extension.

Loss of service continuity cubicle classification

Loss of service continuity class (LSC)

The design is based on “safe compartment access”
Several classes of service continuity during maintenance are defined:

LSC 2A
Safe access to compartment:
- with power flow in busbars and the other units,
- MV cables must be earthed.

LSC 2B
Safe access to compartment:
- with power flow in busbars and the other units,
- MV cable in separate compartment,
- cable of unit under maintenance can remain energized.

LSC 1
Metal enclosed cubicle not of LSC2 class.

Motorpact complies with the definition of LSC2A, and thus provides a fully safe access to the contactor compartment, knowing that maintenance operation:
- the downstream cables to feed motor are not energized and can be earthed,
- the upstream fuse contacts are earthed and segregated from the busbars through the disconnector.

Partition Class I or M
Class defining whether metallic or non-metallic material for separation to live parts is used.

Partition Class PM
All partitions and shutters of safe access compartment shall be metallic with some current carrying capacity.

Partition Class PI
- Partitions or shutters may be partially or totally of insulating material.
- A shutter can be defined as moving contact of a disconnector to engage fixed contacts, to a position where it becomes a part of the enclosure or partition shielding the fixed contacts.

Motorpact complies with Partition Class PI
(earthing switches being shutters for the line and load sides of the equipment)

Internal arc withstand classification IAC AFLR (optional)

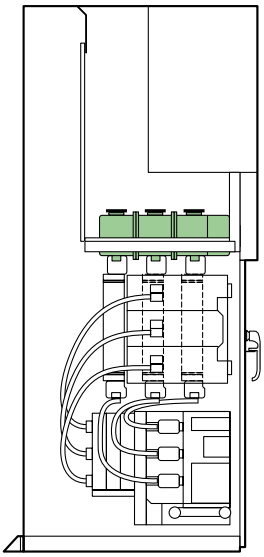
Motorpact internal arc withstand is designed to protect operators in the case of an internal arc and is Internal Arc Classified (IAC).
Successfully tested in conformity with IEC 60271-200 standard (ex IEC 60298), appendix A.
Accessibility is Type A permitting access from the Front side, Lateral side and Rear side (AFLR).
Motorpact is designed to offer a high level of safety by minimizing the effects of internal arcing by:
- using metallic flaps on top of the equipment to limit overpressure in the compartments and to direct the hot gases to the outside, minimizing operator hazards.
- designing multifunctional parts to reduce connections and hardware.
- using non-flammable materials used in the cubicle.
- utilization of concentric compression connections on all flexible bus connections.

Installation in a room must be in accordance with the ceiling height

- **Ceiling height between 2.8 and 4 meters**, it is possible to install a tunnel above the switchboard, in order to channel off the hot gas (due to the effects of internal arcing) and to avoid the gases moving towards any present operators.
- **Ceiling height over 4 meters**, the tunnel is not compulsory.

Line disconnector

DE57730



Maintenance free line disconnector

Use
The line disconnector provides isolation between the busbars compartment and the load compartment.

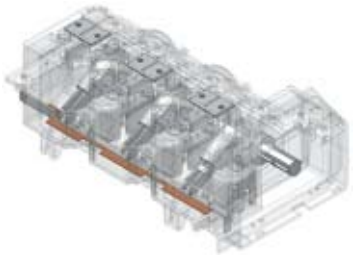
Location
It is situated in the main enclosure at the upper part of the load compartment, and is manually operated from the front of the cubicle.

Description
The disconnector has two positions:
- connected (closed),
- earthed (disconnected).

The disconnector is a non-load break device capable of interrupting the magnetizing current of the control power transformer (5000 operations without maintenance).
The disconnector contacts are readily visible. An optional light is available.
The internal degree of protection is IP2XC.
The load side terminals are integrated into a single multifunctional unit that also integrates the fuse holders (single or double fuses).
The disconnector mechanism incorporates the necessary interlocks to prevent access to the multifunctional compartment with the contactor energized.
Interlocking requires 3 hands to defeat any function.
The disconnector operating mechanism has a pad lockable feature for both the open and closed positions.

Rating
400 Amperes.

PE55147



Options
- **Key interlocks**

Two key interlocks are available:
- one with a removable key when the disconnector is locked in the open position,
- one with a removable key when the disconnector is locked in the open position or with a removable key when the disconnector is in closed position.

- **Disconnector position contact back light**.

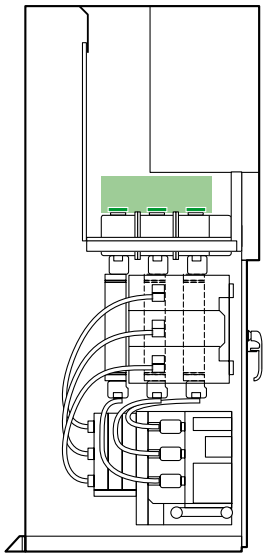
Auxiliary contacts
- 1 set of 4 form C* auxiliary contacts is available for external uses,
  - 1 in the earthed position (disconnector open),
  - 1 in the connected position (disconnector closed).
- 1 set of 4 form C* auxiliary contacts is available as an option.

Characteristics		
Operating voltage	Minimum	48 V
	Maximum	480 V
Rated current		10 A
Breaking capacity	Vdc	60 W (L/R 150 ms)
	Vac	700 VA (power factor 0.35)

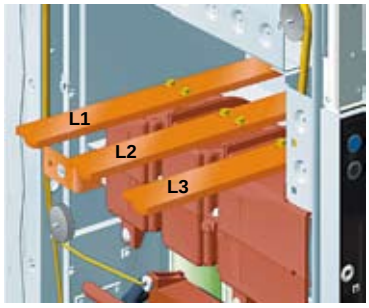
** Common point changeover type contacts*

Busbars compartment

DE57731



PE55146



Phasing relationship

Busbars

Location
The busbars is mounted directly on the disconnector under the LV control cabinet.

Description
The busbars is mounted in the horizontal position. Barriers are provided to isolate the compartment from the rest of the individual vertical section.

Busbars rated current
When the cubicles are part of a main switchboard, the busbars rated current is of the same current rating as the main switchboard.
When Motorpact is used as stand alone equipment, the current rating of the busbars must be greater than the total of the individual currents of each motor starter.

Rating (A)	Short time withstand current		
	3 s		2 s*
	Up to 31.5 kA	40 kA	50 kA*
630	■		■
1250	■	■	■
2500	■	■	■
3150 *	■	■	■

** For stand-alone applications or when lined up with LF circuit breaker MCset switchgear.*

Design of the busbars
The busbars is connected directly on the disconnector terminals.
The connection to the main circuit breaker switchboard is done through a transition cubicle and solid copper busbars links.

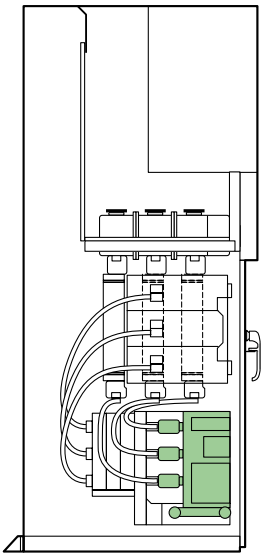
Option
Encapsulated busbars.

Access
Front access only:
For periodic busbars maintenance, access is provided through a removable access cover at the bottom of the LV control cabinet.

Front and rear access:
If rear access is available, busbars maintenance can also be performed from the rear of the cubicle by removing the enclosure cover and the busbars access barrier.

Load compartment
Vacuum contactor

DE57732



The vacuum contactor is used:
- as a Main contactor in all the motor starters and the transformer feeder,
- as a Start and Run contactor in the RVAT motor starter,
- as a By-pass contactor in the RVSS motor starter.

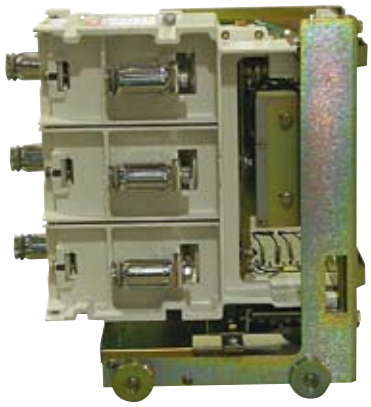
Main fused contactor

Use
Main contactor controls the motor or the transformer feeder.
It can be electrically held or mechanically latched (optional).
It is combined with fuses for high level short-circuit protection.
It is controlled:
- locally,
- remotely.

Description
The vacuum contactor comply with IEC 60470 standard. It comprises:
- 3 vacuum interrupters (breaking);
- an electromagnetic control unit that can be:
  - electrically held,
  - mechanically latched (optional).
- a contactor position indicator,
- a mechanical operation counter (option),
- auxiliary contacts,
- a extraction rail system to remove the contactor.

Location
It is situated below the power fuses, and mounted on rails, in order to be easily removable.

PE55150



Auxiliary contactors

RVAT Start contactor
Use: an electrically held contactor to connect the auto-transformer in Y during the first step of the starting time.

RVAT Run contactor
Use: an electrically held contactor to by pass the auto-transformer after the motor has reached operating speed.
For RVAT, the Main and the Run contactors are switched automatically by the control logic.

RVSS By-pass contactor
Use: an electrically held contactor to by pass the SoftStart after the motor has reached operating speed.
For RVSS, an integral digital controller controls both the Main and the By-pass contactors.

Location
Start, Run and By-pass contactors are installed on rails in the upper compartment of the auto-transformer or SoftStart cubicle.
All these contactors are interchangeable with each other and with the Main contactor.

Load compartment
Vacuum contactor

Vacuum contactor characteristics

Electrical characteristics			
Rated voltage		7.2 kV	
Rated current		200/400 A	
Category of use		AC3/AC4	
Rated short circuit breaking capacity (without fuse)		6.3 kA	
Electrical endurance		250 000 operations	
Mechanical life	Mechanically latched type	250 000 operations	
	Electrically held type	2 500 000 operations	
Chopping current (Avg.RMS)		0.5 A	
Rated switching frequency		1200/hour	
		300/hour for mechanically latched version	
Maximum closing time		80 ms or less	
Maximum opening time		30 ms or less	
		300 ms or less (delayed)	
Control			
Supply voltage	Vdc	100/125	240/250
	Vac	115/120	230/240
	possible variations:	+10% –15%	
Consumption	Closing is achieved via the closing coils. The holding coils are inserted in the circuit at the end of the closing.		
		Closing	Holding
	100-110 V	670 VA 80 ms	85 VA

PE55151

Auxiliary contacts

The auxiliary contacts are of the changeover type with a common point.
The following are available:
- 3 NO + 3 NC for the electrically held version (optional 3 NO & 3 NC additional auxiliary contacts),
- 5 NO + 6 NC for the mechanically latched version as standard.

Characteristics		
Operating voltage	Minimum	48 V
	Maximum	480 V
Rated current		10 A
Breaking capacity	Vdc	60 W (L/R 150 ms)
	Vac	700 VA (power factor 0.35)

Options

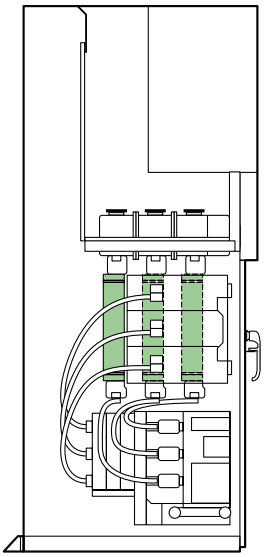
- **Mechanical operation counter**
- **Mechanically latched contactor** (including open release)

The open release allows opening of the contactor when mechanically latched.
It is supplied with:
- mechanical position indicator,
- padlock provision: closed position,
- 1 key interlock: open or closed position (optional),
- 1 emergency mechanical trip pushbutton.

Open release characteristics			
Power supply (Vdc)	48	125	250
Consumption (W)	470	680	640
Response time (ms)	20-40	20-41	20-40

Load compartment
MV fuses

DE57733



MV fuses

Use
MV power fuses are used for short circuit current protection.
Sepam series 20, 40 or 80 digital relay provides fine protection, and metering and control of the motor or transformer.

Characteristics
Fuses comply with IEC 60282.1 and DIN 43625 standards, with high breaking capacity.
High fault current limitation reduces electrodynamic stresses on the load-side components (contactor, cables, CT's, etc).
A blown fuse indicator is provided to open the three poles of the contactor, in case of single phase or two-phase fault.

Maximum service voltage	7.2 kV
Maximum fuse rating	2 x 315 A
Breaking capacity	50 kA

Motor application

Quantity and rated current of the fuses
Select from the table page 49.
It is essential to verify, specially in case of rating change (change in motor power for instance), that dimensioning rules are satisfied.

Dimensioning rules
Accumulation of starting sequences
The "check-point" current (2 x Id) must be lower than the minimum clearing current (I3) of the fuse.

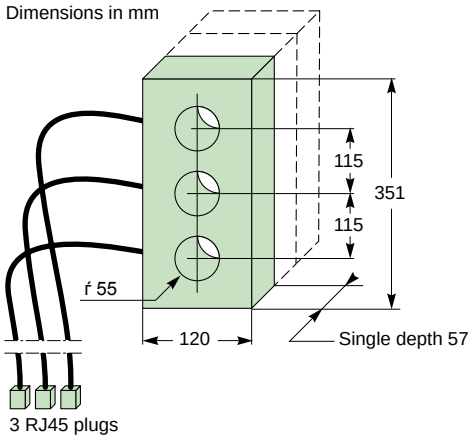
Saturation of sensors
■ In order to be sure that fault currents will be "seen" by the fuses, the "accuracy limit current" of the sensors must be higher than the minimum clearing current (I3) of the fuse.
■ In order to insure the correct functioning of the thermal image protection of the Sepam relay, the sensor rating must be lower than 3 times the normal motor current.
Corollary: do not over-rate the sensors.

Transformer application

Quantity and rated current of the fuses
See table page 49.

Load compartment
Current sensors

DE57734EN



CLV1 low power current transducer (LPCT)

The LPCT is the standard current sensor for Motorpact.
It consists of a three core voltage current sensor which complies with the IEC 60044-8 standard.
One sensor covers all the applications.

Use

The LPCT is compatible with Sepam series 20, series 40 or series 80 digital relays and provide the required performance for the protection and measuring functions of transformer and motor applications.

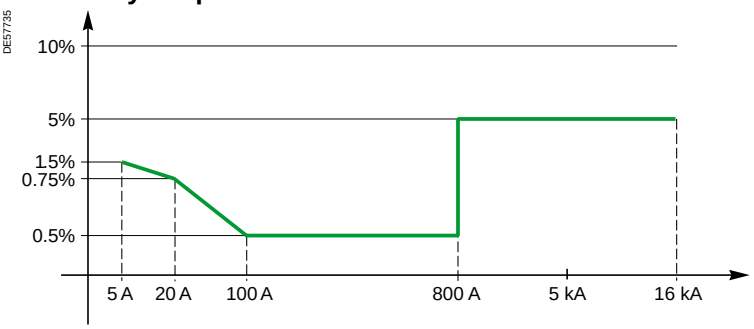
Due to its linearity, a single LPCT covers the entire operating range.
If the motor changes, only the setting of the Sepam protection relay has to be modified (see also rule on previous page).

Characteristics

	LPCT
Rated primary current	100 A
Rated extended primary current	800 A
Rated secondary output	22.5 mV
Accuracy class for measuring	0.5%
Accuracy limit factor	160
Accuracy class for protection	5P
Burden	≥ 2 kΩ
Rated continuous thermal current	800 A
Thermal current surge	5 kA/10 s
Rated short-time thermal current	16 kA
Highest voltage for equipment	0.72 kV
Rated power frequency withstand voltage	3 kV
Service conditions	– 25°C, indoor

Accuracy template

DE57735



Due to its linearity, a single LPCT covers the entire operating range.

Location

It is located on the CT and load terminal assembly providing the required support and ensuring dielectric withstand.

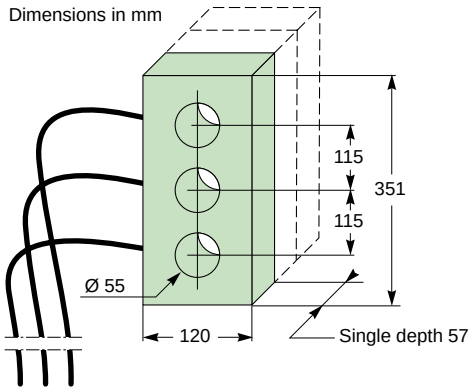
PE55152

Wiring and cables

Each cable is 5 meters long and is embedded in the LPCT enclosure.
The 3 RJ45 plugs are equipped with color coded terminals that mate up to color coded sockets on the Sepam eliminating possible connection errors.

Load compartment
Current sensors

DE57736EN



Phase current transformer

Use
Alternatively, Motorpact can be supplied with a three core phase CT.
This CT is optimised for Sepam digital relays and will provide performance and protection for the system.

Accuracy ratings

Rated current	Single depth = 57 mm	Double depth = 114 mm
30 A/1A		2.5 VA 10P5 or 2.5 VA cl. 3
30 A/5A		5 VA 10P5 or 5 VA cl. 3
50 A/1A		5 VA 10P5 or 5 VA cl. 3
50 A/5A		5 VA 10P5 or 5 VA cl. 3
100 A/1A	2.5 VA 5P5 or 2.5 VA cl. 1	
100 A/5A	5 VA 5P5 or 5 VA cl. 1	
150 A/1A	2.5 VA 5P5 or 10 VA cl1 or 2.5 VA cl. 0.5	
150 A/5A	5 VA 5P5 or 2.5 VA cl. 0.5	
200 A/1A	2.5 VA 5P5 or 5 VA cl. 0.5	
200 A/5A	5 VA 5P5 or 2.5 VA cl. 0.5	
250 A/1A	2.5 VA 5P5 or 10 VA cl. 0.5	
250 A/5A	5 VA 5P5 or 2.5 VA cl. 0.5	
300 A/1A	2.5 VA 5P5 or 15 VA cl. 0.5	
300 A/5A	5 VA 5P5 or 5 VA cl. 0.5	
400 A/1A	2.5 VA 5P5 or 30 VA cl. 0.5	
400 A/5A	5 VA 5P5 or 10 VA cl. 0.5	

For all other needs, please consult us.

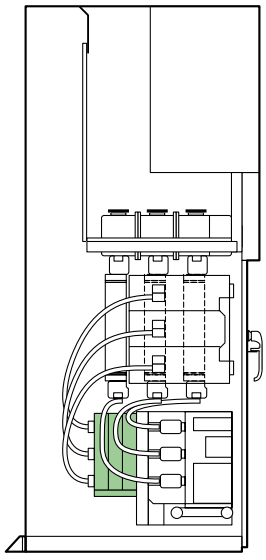
It is essential to verify, specially in case of rating change (change in motor power for instance), that dimensioning rules are satisfied. See page 34.

All CT's comply with measuring and protection requirements:
- single depth: 57 mm,
- double depth: 114 mm.

Note: for rated currents lower than 75 A, the best solution is to use the LPCT (see previous page).

Location
It is located on the CT and load terminal assembly providing the required support and ensuring all dielectric withstand.

DE57737



Zero sequence current transformer
Three types of zero sequence current transformer (ZSCT) may be used:

Internally mounted zero sequence CT
Use
The internally mounted zero sequence current transformer is used for earth fault protection when the expected value of the fault current is higher than 50 A (direct earthing system).
Location and size
The internally mounted zero sequence current transformer is installed with the LPCT or CT. Its depth is a single depth (57 mm).

Internally mounted CSH 280 core balance CT
Use
CSH core balance CTs, provide more sensitive protection by direct measurement of earth fault currents.
Specifically designed for the Sepam range, they can be directly connected to the Sepam "residual current" input.
Location and size
The internally mounted CSH 280 core balance CT is installed with the LPCT or CT. Its depth is a single depth (57 mm).

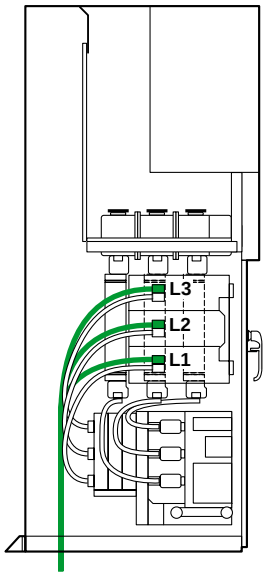
E28678

Externally mounted CSH 120 and CSH 200 core balance CTs
Use
Same use as CSH 280.
They are installed in the cable tray under the cubicle around the cable.
- CSH 120 - 120 mm internal diameter core balance CT
- CSH 200 - 200 mm internal diameter core balance CT

A hole would need to be drilled on site to pass the wires.

Load compartment
Cable connection

DE57738



Phasing relationship

Cable connection

Capability
- Up to 2 x 120 mm^2 or 1 x 240 mm^2 single or three core dry cables.
- Screened and non-screened cable.
- Armoured or non-armoured cable.

Location
Cable termination pads are located on the left side of the main contactor FVNR unit for all applications including auto-transformers and SoftStarts. They are situated 310 mm from the front of the cubicle to allow for easy access during installation and maintenance. The cable termination pads are suitable for:
- 1 cable max. 240 mm^2 or
- 2 cables max. 120 mm^2.

Equipment cable access

FVNR

Cable termination pads are designed for easy accessible from the front of the cubicle. Cables can exit as follows:

Cable type 7.2 kV max.	Utility space	Front and rear access		Front access only	
		Top	Bottom	Top	Bottom
Single core		■	■	■	■
Three core		■	■	■	
Single core	■	■	■	■	■
Three core	■	■	■	■	■

Incoming line

Cable termination pads are designed to be easily accessible from the front of the cubicle. Cables can exit as follows:

Incoming cubicle width	Front and rear access		Front access only	
	Top	Bottom	Top	Bottom
500 mm		■		■
750 mm	■	■	■	■

Load termination pads
Load termination pads are provided with a two hole configuration permitting the use of virtually any one or two hole cable connecting lug. To prevent single hole cable lugs from rotating, provision is provided to clamp the cable.

An earth busbar is provided for termination of the cable screen.

Floor plates are available to prevent the ingress of dust and vermin.

A dielectric barrier (Formex) is provided over the cable termination pads.

When rear access is available, removable rear covers provide simple and easy cable termination. In addition, a removable top entry cover at the rear section of each FVNR cubicle provides a full height cable pull area.

PE55162

Front access

PE55163

Rear access

PE55164

Floor cable entry

Load compartment
Optional equipment

PE55156

Cable earthing switch

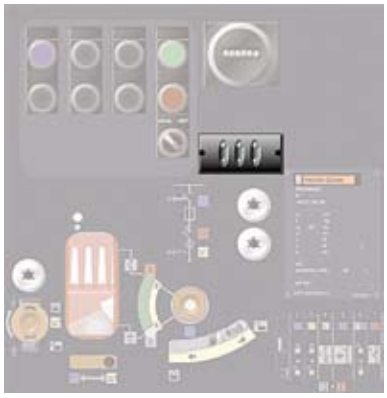
Use
The cable earthing switch earths the outgoing cables and allows to discharge them.

Location
It is situated on the load side of the contactor.

Description

Electrical characteristics	
Earthing switch making capacity	14 kA peak
No load operations according to IEC standard	1000
Direct visual indication of the position of the device on the front face	
Auxiliary contacts	
2 NO and 2 NC auxiliary contacts are available in open and closed position	
Interlocking	
The earthing switch is mechanically interlocked with the disconnector and the MV front door. As an option: a key interlock is available in closed or open position. Earthing switch is provided with padlock provision in open and closed positions. An optional key interlock blocks access to the operating handle thus locking the earthing switch in either the open or closed position.	

PE56477



Voltage presence indicator system (VPIS)

Use
This device enables to check the presence (or absence) of voltage in the cables.
It is in accordance with IEC 61958.

Location
The sensors are located on the cable termination box, indicators on the front face.

Heater resistor

Use
Heaters are required to prevent condensation when the cubicle is installed in a humid atmosphere or is de-energized for extended periods of time.

Description
One heater resistor 50 W/230 Vac.
The heater resistor is controlled by a miniature circuit breaker.
The heater is switched off when the contactor is energized.

Load compartment
Optional equipment

PE55158

Control Power Transformer (CPT)

Use
To supply power to the closing coil of the contactor, two solutions can be used:
- an external DC or AC auxiliary,
- an internal supply. A control power transformer (CPT) can be provided and installed into the cubicle.

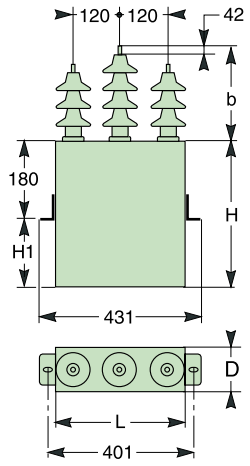
The CPT is used to close (inrush current) and to electrically hold the contactor.
If the contactor is mechanically latched, the CPT is used only to close the contactor.
Generally a reliable auxiliary supply is utilized in the release circuit of the contactor.

Characteristics
The CPT is protected with two MV fuses and the secondary by a miniature circuit breaker.
Electrical interlocking is provided in the CPT secondary to disconnect the load of the CPT before opening the disconnector. This prevents the possibility of backfeeding the CPT.
Two types of CPT are available:
- VRCR 200 VA capable of supplying one contactor and associated auxiliaries
- CPT 300 VA capable of supplying all contactors and associated auxiliaries in reduced voltage motor starting applications
- CPT 750 VA supplied as standard in RVSS. Optional for other applications
- CPT 2000 VA optional when additional power is required for downstream components.

Primary CPT MV fuses are connected to the load side of the main fuses.
Type: Ferraz
< 5.5 kV 20 mm diameter and 127 mm length,
> 5.5 kV 20 mm diameter and 190 mm length.

Location
CPT is placed under the contactor on the floor of the cubicle.
The CPT fuses and holders are accessible from the front for easy fuse replacement.

DE57739EN



Three-phase Propivar capacitor

Power factor correction capacitor

Three phase capacitors: without internal fuses
Possible for FVNR3 cubicle (750 mm width).

Network voltage (V) 6600 6300 6000 5500 Capacitor voltage (V) 6600 6300 6000 5500				Dimensions (mm)					Weight (kg)
Power (kvar)				H	L	D	b	H1	
50	45	40	35	300	347	190	135	120	20
100	90	80	70	300	347	190	135	120	28
150	135	120	105	400	347	190	135	220	35
200	180	160	140	500	347	190	135	320	44
250	225	200	175	810	347	165	135	630	49
300	270	240	210	700	347	190	135	520	58
350	315	280	245	700	347	190	135	520	64
400	360	320	280	810	347	190	135	630	73
450	405	360	315	810	347	190	135	630	79

These capacitors could be available in stock: please consult us

Option
Temperature class –25/+55°C
Clamping for 1 cable connection
Clamping for 2 cables connection

Load compartment
Optional equipment

PE55160

Thermal diagnosis system

Use
To reduce maintenance costs in MV substations.
It continuously monitors temperature rise using optical fibres and sensors installed at the heart of the sensitive areas.
The sensors are located on cable connections and on top MV fuse holders.

Presentation
Thermal diagnosis is based on the principle of temperature measurement of energized circuits. By using optical fibres, the system doesn't introduce any risks in terms of insulation.
It provides:
- permanent monitoring of the temperature rise in power circuits at the connections,
- tripping of a "pre-alarm", then an "alarm" by activating dry contact outputs,
- indication of the zone and circuit involved.

The standard solution is composed of the MDT module and two probes as described hereunder.

Probes CFO733
The optical fibre probes are factory-built assemblies comprising:
- 3 sensors attached to the power circuit,
- the optical connections,
- a connector linked to the module.

This connector incorporates the opto-electrical conversion unit thus eliminating any optical connections when assembling.

MDT107 module
The MDT107 electronic module is mounted in the low voltage compartment of the cubicle. It provides the following functions:
- monitoring of temperature rise in 2 zones,
- triggering of the pre-alarm,
- triggering of the alarm,
- self-monitoring of the module,
- self monitoring of the temperature probes.

Technical characteristics

Optical fibre probes CF0733		
Maximum equipment voltage		17.5 kV
Rated power frequency voltage		38 kV
Impulse voltage		95 kV
Maximum fibre/sensor temperature		120°C
MDT107 module		
Temperature rise setting		To be defined
Storage temperature		–25°C to +70°C
Values of maximum absolute thresholds		Pre-alarm = 115°C
		Alarm = 120°C
DIN profile width		10.5 cm
Module power		24/250 Vdc, 110/240 Vac
Dry contact voltage	Voltage	24, 48, 127, 220 Vdc
		110 to 240 Vac
	Current	5 A permanent (pre-alarm)
		8 A permanent (alarm)
Consumption (standby-max.)	AC	< 1.2 W (standby) - < 3.4 W (max.)
	DC	< 4.4 VA (standby) - < 6.6 VA (max.)

Operating panel

PE56476

Operating panel

The operating front panel comprises different control and indicating elements:
- control “Run” and “Stop” pushbuttons,
- indicating lights,

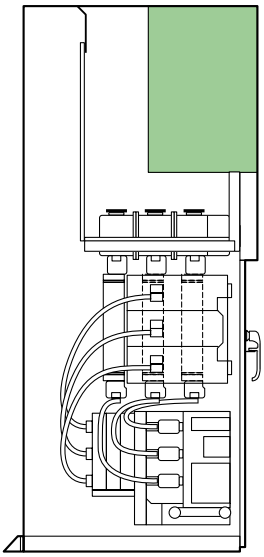
Both can be replaced by an optional Sepam 100 MI control and indication device.
- local-remote switch (optional),
- mimic diagram,
- operating sequence,
- open closed indicator,
- running time meter (optional), as well as voltage presence indication system.

The operating front panel allows control, interlocking and padlocking:
- earthing switch operator,
- earthing switch key interlock,
- disconnector operator,
- disconnector key interlock,
- disconnector padlock provision,
- earthing switch padlock provision.

It comprises also a viewing window and a pushbutton for the disconnector and load compartment back light.

LV control cabinet
LV enclosure

DE57740



PE86475

LV enclosure

Use
To install all local protection and control LV equipment.

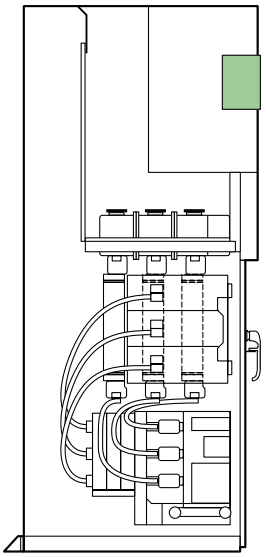
Structure
The low voltage control cabinet is separated from the MV compartment by earthed metal barriers.
A hinged door is situated at the upper part of the front of the enclosure and above the busbars compartment.
Relays and local control devices are flush mounted on the door of the cabinet.
Terminals, miniature circuit breaker, auxiliary relays are fixed on DIN rails inside the cabinet.

Under the LV control cabinet, in front of the busbars compartment a fix escutcheon gets together pushbutton, lamps, voltage presence indicator system, and a position disconnector mechanical indicator.

LV control cabinet
Sepam protection system

Each Motorpact unit is equipped with a comprehensive protection, control and measuring system comprising:
- *instrument transformers to measure the necessary electrical values (phase current, residual current, voltages, etc.),*
- *Sepam protection relay adapted to the application,*
- *metering equipment,*
- *low voltage auxiliary relays.*

DE57741



PE55170

Sepam digital protection relay

Sepam is at the heart of the protetion chain.
It carries out all the necessary protection, control, monitoring and signalling functions and provides an optimal solution for each application:
- **Sepam T**, transformer feeder,
- **Sepam M**, motor starter,
- **Sepam B or S**, for busbars, substation and capacitor application.

Sepam series 20, series 40 and series 80, a modular solution

To satisfy increasing numbers of applications, and allow the installation to be upgraded:
- basic, advanced or mimic - based User-Machine Interface.

The advanced UMI with graphic LCD screen and keypad, can be remotely located.
- functional enhancement by optional modules:
  - 42 logic inputs and 23 relay outputs with 3 optional modules,
  - Modbus communication network connection interface,
  - 8 to 16 temperature probes acquisition module,
  - analog output (4-20 mA),
  - Synchro-check module.

Sepam: simplicity and performance

Easy to install
- optional modules common for all Sepam and easy to implement.

Assisted commissioning
- pre-defined functions commissioned by a simple parameter setting,
- user-friendly and powerful PC software for parameter and protection setting.

User-friendly
- intuitive User Machine Interface with direct data access,
- local operating data in the user's language.

Protection in Motorpact units

The basic equipment of each Motorpact unit comprises an adapted protection system.

Motorpact unit	Standard	Optional
FVNR	Sepam M20	Sepam M40 or M80
RVAT	Sepam M41	Sepam M40 or M80
RVSS	SoftStart relay	Sepam M40 or M80
Transformer feeder	Sepam T20	Sepam T40 or T80

For any other types of Sepam relay, please consult us.

LV control cabinet
Sepam protection system

Sepam functions
The main functions performed by the Sepam units proposed as basic equipment of Motorpact units are summarized in the table opposite.
For other details, please refer to the Sepam catalogue.

The figures indicate the number of relays available for each protection function.

		Transformer	Motor	
Protection	**ANSI code**	**T20**	**M20**	**M41**
Phase overcurrent	50/51	4	4	4
Earth fault / Sensitive earth fault	50N/51N 50G/51G	4	4	4
Breaker failure	50BF			1
Negative sequence / unbalance	46	1	1	2
Directional earth fault	67N/67NC			2
Directional active overpower	32P			1
Directional reactive overpower	32Q/40			1
Thermal overload	49RMS	2	2	2
Phase undercurrent	37		1	1
Excessive starting time, locked rotor	48/51LR/14		1	1
Starts per hour	66		1	1
Positive sequence undervoltage	27D			2
Remanent undervoltage	27R			1
Undervoltage (4)	27/27S			2
Overvoltage (4)	59			2
Neutral voltage displacement	59N			2
Negative sequence overvoltage	47			1
Overfrequency	81H			2
Underfrequency	81L			4
Temperature monitoring (8 RTDs)	38/49T	□	□	
Temperature monitoring (8 or 16 RTDs)	38/49T			□
Thermostat / Buchholz	26/63	□		
Metering				
Phase current I1, I2, I3 RMS, residual current I0		■	■	■
Demand current I1, I2, I3, peak demand current IM1, IM2, IM3		■	■	■
Voltage U21, U32, U13, V1, V2, V3, residual voltage V0				■
Positive sequence voltage Vd / rotation direction Negative sequence voltage Vi				■
Frequency				■
Active, reactive and apparent power P, Q, S Peak demand power PM, QM, power factor				■
Calculated active and reactive energy (±W.h, ±var.h)				■
Active and reactive energy by pulse counting (±W.h, ±.varh)				□
Temperature		□	□	□
Network and machine diagnosis				
Tripping context				■
Tripping current TripI1, TripI2, TripI3, TripI0		■	■	■
Unbalance ratio / negative sequence current Ii		■	■	■
Phase displacement φ0, φ1, φ2, φ3				■
Disturbance recording		■	■	■
Thermal capacity used		■	■	■
Remaining operating time before overload tripping		■	■	■
Waiting time after overload tripping		■	■	■
Running hours counter / operating time		■	■	■
Starting current and time			■	■
Start inhibit time, number of starts before inhibition			■	■
Switchgear diagnosis				
Cumulative breaking current		■	■	■
Trip circuit supervision		□	□	□
Number of operations, operating time, charging time		□	□	□
CT / VT supervision	60FL			■
Control and monitoring	**ANSI code**			
Circuit breaker / contactor control (1)	94/69	□	□	■
Latching / acknowledgement	86	■	■	■
Logic discrimination	68	□	□	□
Switching of groups of settings		■ (2)	■ (2)	■
Annunciation	30	■	■	■
Logic equation editor				■
Additional modules				
8 temperature sensor inputs - MET148-2 module		□	□	□ (3)
1 low level analog output - MSA141 module		□	□	□
Logic inputs/outputs - MES114/MES114E/MES114F (10I/4O) module		□	□	□
Communication interface - ACE949-2, ACE959, ACE937, ACE969TP or ACE969FO		□	□	□

LV control cabinet
Sepam protection system

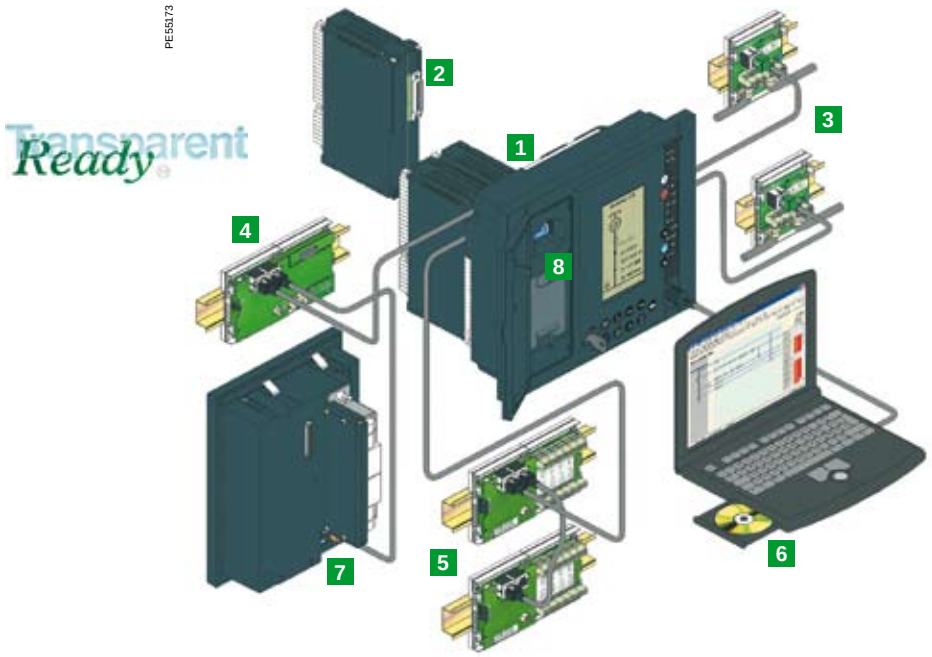
Protection	ANSI code	Motor M81	M87	M88
Phase overcurrent (1)	50/51	8	8	8
Earth fault / Sensitive earth fault (1)	50N/51N 50G/51G	8	8	8
Breaker failure	50BF	1	1	1
Negative sequence / unbalance	46	2	2	2
Thermal overload for machines (1)	49RMS	2	2	2
Two-winding transformer differential	87T			1
Machine differential	87M		1	
Directional earth fault (1)	67N/67NC	2	2	2
Directional active overpower	32P	2	2	2
Directional reactive overpower	32Q	1	1	1
Phase undercurrent	37	1	1	1
Excessive starting time, locked rotor	48/51LR	1	1	1
Starts per hour	66	1	1	1
Field loss (underimpedance)	40	1	1	1
Pole slip	78PS	1	1	1
Overspeed (2 set points) (2)	12	□	□	□
Underspeed (2 set points) (2)	14	□	□	□
Positive sequence undercurrent	27D	2	2	2
Remanent undervoltage	27R	2	2	2
Undervoltage (L-L or L-N)	27	4	4	4
Overvoltage (L-L or L-N)	59	4	4	4
Neutral voltage displacement	59N	2	2	2
Negative sequence overvoltage	47	2	2	2
Overfrequency	81H	2	2	2
Underfrequency	81L	4	4	4
Thermostat / Buchholz (2)	26/63	□		□
Temperature monitoring (16 RTDs) (3)	38/49T	□	□	□
Control and monitoring				
Circuit breaker / contactor control	94/69	□	□	□
Load shedding / automatic restart		■	■	■
Logic discrimination (2)	68	□	□	□
Latching / acknowledgement	86	■	■	■
Annunciation	30	■	■	■
Switching of groups of settings		■	■	■
Adaptation using logic equations		■	■	■
Logipam programming (Ladder language)		□	□	□

Metering	Motor M81	M87	M88
Phase current I1, I2, I3 RMS	■	■	■
Measured residual current I0, calculated I0Σ	■	■	■
Demand current I1, I2, I3	■	■	■
Peak demand current IM1, IM2, IM3	■	■	■
Measured residual current I'0	■	■	■
Voltage U21, U32, U13, V1, V2, V3	■	■	■
Residual voltage V0	■	■	■
Positive sequence voltage Vd / rotation direction	■	■	■
Negative sequence voltage Vi	■	■	■
Frequency	■	■	■
Active power P, P1, P2, P3	■	■	■
Reactive power Q, Q1, Q2, Q3	■	■	■
Apparent power S, S1, S2, S3	■	■	■
Peak demand power PM, QM	■	■	■
Power factor	■	■	■
Calculated active and reactive energy (±Wh, ±VARh)	■	■	■
Active and reactive energy by pulse counting (2) (± Wh, ± VARh)	□	□	□
Phase current I'1, I'2, I'3 RMS		■	■
Calculated residual current I'0Σ		■	■
Temperature (16 RTDs) (3)	□	□	□
Rotation speed (2)	□	□	□
Neutral point voltage Vnt	■	■	■
Network and machine diagnosis			
Tripping context	■	■	■
Tripping current TripI1, TripI2, TripI3	■	■	■
Phase fault and earth fault trip counters	■	■	■
Unbalance ratio / negative sequence current Ii	■	■	■
Harmonic distortion (THD), current and voltage Ithd, Uthd	■	■	■
Phase displacement φ0, φ'0, φ0Σ	■	■	■
Phase displacement φ1, φ2, φ3	■	■	■
Disturbance recording	■	■	■
Thermal capacity used	■	■	■
Remaining operating time before overload tripping	■	■	■
Waiting time after overload tripping	■	■	■
Running hours counter / operating time	■	■	■
Starting current and time	■	■	■
Start inhibit time	■	■	■
Number of starts before inhibition	■	■	■
Unbalance ratio / negative sequence current I'i		■	■
Differential current Idiff1, Idiff2, Idiff3		■	■
Through current It1, It2, It3		■	■
Current phase displacement θ		■	■
Apparent positive sequence impedance Zd	■	■	■
Apparent phase-to-phase impedances Z21, Z32, Z13	■	■	■
Switchgear diagnosis	**ANSI code**		
CT / VT supervision	60/60FL	■	■	■
Trip circuit supervision (2)	74	□	□	□
Auxiliary power supply monitoring		■	■	■
Cumulative breaking current		■	■	■
Number of operations, operating time, charging time, number of racking out operations (2)		□	□	□
Modbus communication, IEC 60 870-5-103 or DNP3				
Measurement readout (5)		□	□	□
Remote indication and time tagging of events (5)		□	□	□
Remote control orders (5)		□	□	□

The figures indicate the number of relays available for each protection function.
■ *standard*
□ *options.*
(1) *Protection functions with 2 groups of settings.*
(2) *According to parameter setting and optional MES120 input/output modules.*
(3) *With optional MET148-2 temperature input modules.*
(4) *With optional MCS025 synchro-check module.*
(5) *With ACE949-2, ACE959, ACE937, ACE969TP or ACE969FO communication interface.*

LV control cabinet
Sepam protection system

Sepam series 20, series 40 and series 80 modularity



1 - Sepam base unit
Available with 3 User-Machine Interface (UMI) levels:
- basic UMI, with signal lamps
- advanced UMI, with keypad and graphic LCD display.

This advanced UMI can be remotely located and its screens can be customised in all languages.
- mimic-based UMI for Sepam series 80

This mimic-based UMI offers the local switchgear control.

2 - Logic I/O module
The 4 outputs on the Sepam series 20 and series 40 base unit may be completed by adding an MES114 module with 10 input/4 output on the back of the base unit.
The 5 output relays included on the Sepam series 80 base unit may be extended by adding 1, 2 or 3 MES120 modules with 14 DC logic inputs and 6 outputs relays,1 control relay output and 5 indication relay outputs.

3 - ACE communication interfaces
With Modbus communication, Sepam series 20, series 40 or series 80 units can be connected to a monitoring and control system equipped with a master Modbus communication channel.
To connect Sepam series 20, 40 or 80 to a RS485 network, an interface module is required:
- ACE949-2, interface for connection to a 2-wire RS485 network
- ACE959, interface for connection to a 4-wire RS485 network
- ACE937, interface for connection to a fiber optic network
- ACE969, interface for connection to 2 independent communication networks: a 2-wire RS485 network or a fiber-optic network and a 2-wire RS485 network.

4 - MSA141 analog output module
The MSA141 module converts one of the Sepam series 20, series 40 and series 80 measurements into a 0-10 mA, 4-20 mA or 0-20 mA analog signal.

5 - MET148-2 temperature sensor module
Temperature measurement (e.g. in transformer or motor windings) is used by the following protection functions:
- thermal overload (to take into account the ambient temperature)
- temperature monitoring.

With the MET148-2 module, 8 Pt100, Ni100 or Ni120 temperature sensors can be connected.

6 - SFT software tools
- SFT2841, setting and operating Sepam software. The control and monitoring functions can be customised by the use of the SFT2841 software.
- SFT2826, disturbance recording data display software.

7 - Synchro-check module
This optional module available only on Sepam series 80 base unit checks the voltages upstream and downstream of a circuit breaker to ensure safe closing.

8 - Parameter and protection settings saved on removable memory cartridge
Sepam series 80 has a removable memory cartridge to simplify maintenance operations in order to fasten return to service following replacement.

LV control cabinet
Local/remote control device

Local/remote control device

Use
Local/remote control of the contactor.

Characteristics
Two possibilities:
- integrated Sepam 100MI solution,
- basic solution.

PE60116

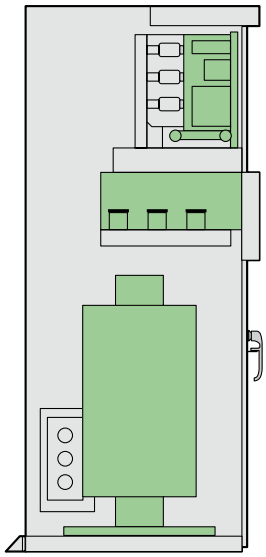
Sepam 100 MI
Sepam 100 MI is a local breaking device control and signalling module.
The front of Sepam 100 MI includes the following mimic:
- red and green indicator units used to make up mimic diagrams representing the cubicle electrical diagram,
- a red vertical bar representing “device closed”,
- a green horizontal bar representing “device open”,
- a local or remote control selector switch (CLR),
- a breaking device open control pushbutton (KD2), active in local or remote mode,
- a breaking device close control pushbutton (KD1), active only in local position.

Sepam 100 MI can be installed either separately or combined Sepam series 20, series 40 or series 80.

Location
It is mounted on the LV control cabinet door.

Auto-transformer compartment

DE57742



Auto-transformer module

Use

This module is always erected on the right side of the main cubicle to compose the auto-transformer starter.

Selection

Two widths of modules are available:

- 1125 mm wide for motor up to 440 kW,
- 1500 mm wide for motor lower than 3800 kW.

Structure

The main busbars goes through the module in a segregated compartment.
It provides an IP2XC protection inside the enclosure.
It splits the module in two parts:

- the upper part with the two vacuum contactors (start and run).

The door has two optional windows to see the status of the contactors.

- the lower part with the auto-transformer.

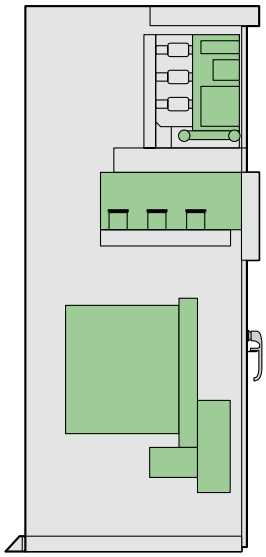
The medium voltage doors are mechanically interlocked with the disconnector of the main cubicle.

Dry cables are used to connect the auto-transformer and the contactors to the main cubicle.
Current sensors, earthing switch, voltage presence indication system, customer's terminations are in the main cubicle.
Provision is supplied in the auto-transformer module to install a current transformer for accurate measurement of motor current.

Auto-transformer modules are designed to ship connected to the main cubicle.

SoftStart compartment

DE57743



Characteristics	
Voltage	2.3 kV - 7.2 kV
Frequency	50 or 60 Hz
Unit overload capacity	125 % - Continuous 500 % - 60 seconds 600 % - 30 seconds
Power ranges	3.3 kV to 1900 kW 5.5 kV to 3000 kW 7.2 kV to 3800 kW
Power circuit	6 SCRs, 12 SCRs or 18 SCRs

SoftStart module

Use

This module is always erected on the right side of the main cubicle to compose the SoftStart motor starter.

Selection

One width of module is available:

- 750 mm wide for rated current up to 400 A.

Structure

The main busbars goes through the module in a segregated compartment.
It splits the module in two parts:

- the upper part with the by-pass vacuum contactor,
- the lower part with the MV SoftStart device.

The upper medium voltage door has an optional window to see the status of the bypass contactor. The medium voltage doors are mechanically interlocked with the disconnector of the main cubicle.
A low voltage compartment in the centre of the module contains the logic and control of the SoftStarter.
Dry cables are used to connect the SoftStart module to the main cubicle.
Earthing switch, voltage presence indication system, customer's terminations are in the main cubicle.
SoftStart modules are designed to ship connected to the main cubicle.

Keypad interface

Motorpact SoftStart offers keypad display/programming and serial communications. A 2 line x 20 character LCD display with backlight provides easy readout of multiple motor data points.

Motor protection functions

- over current,
- under current,
- current imbalance,
- two stage overload,
- reset,
- number of starts per hour.

Metering functions

- motor load,
- phase current, average current, earth fault current,
- thermal capacity remaining, thermal capacity to start,
- average start time, current, capacity to start, elapsed time from last start,
- up to 12 RTD's data,
- kW, kvar, power factor, kWh.

Communication

- protocol: Modbus,
- RS 485.

MV fuses
Selection guide

Motor application

Starting current (A) Id/In = 6	Normal current (A)	Minimum CT rating (sec. 1 A)	LPCT	Starting time (s) 5		10		30	
				Number of starts per hour 3	6	3	6	3	6
2400	400	400	valid with	2 x 315	2 x 315	2 x 315	2 x 315	2 x 315	2 x 315
2200	366	400	all fuse	2 x 315	2 x 315	2 x 315	2 x 315	2 x 315	2 x 315
2000	333	300	ratings	2 x 250	2 x 250	2 x 250	2 x 250	2 x 250	2 x 250
1725	288	300		2 x 250	2 x 250	2 x 250	2 x 250	2 x 250	2 x 250
1570	262	300		2 x 200	2 x 200	2 x 200	2 x 200	2 x 200	2 x 250
1415	235	75		1 x 315	1 x 315	1 x 315	1 x 315	1 x 315	2 x 200
1256	209	75		1 x 315	1 x 315	1 x 315	1 x 315	1 x 315	1 x 315
1100	183	75		250	250	250	1 x 315	1 x 315	1 x 315
942	157	75		250	250	250	250	250	250
785	131	75		200	200	200	200	200	250
628	105	75		160	160	160	200	200	200
565	94	75		160	160	160	160	160	160
502	84	75		125	160	160	160	160	160
439	73	75		125	125	125	160	160	160
377	63	75		100	125	100	125	125	160
314	52	30		100	100	100	100	100	125
251	42	30		100	100	100	100	100	100
188	31	30		80	100	100	100	100	100
126	21	30		50	50	63	80	80	80
63	10	30		32	32	32	40	40	40
47	8	30		25	32	32	32	32	32
31	5	30		25	25	25	25	25	25

Note:
- fuses are 442 mm long,
- fuses are only for short circuit protection,
- for starting currents lower than 170 A, we recommend the LPCT.

It is necessary to delay the tripping of the contactor

Transformer application

Quantity and rated current for Fusarc fuses

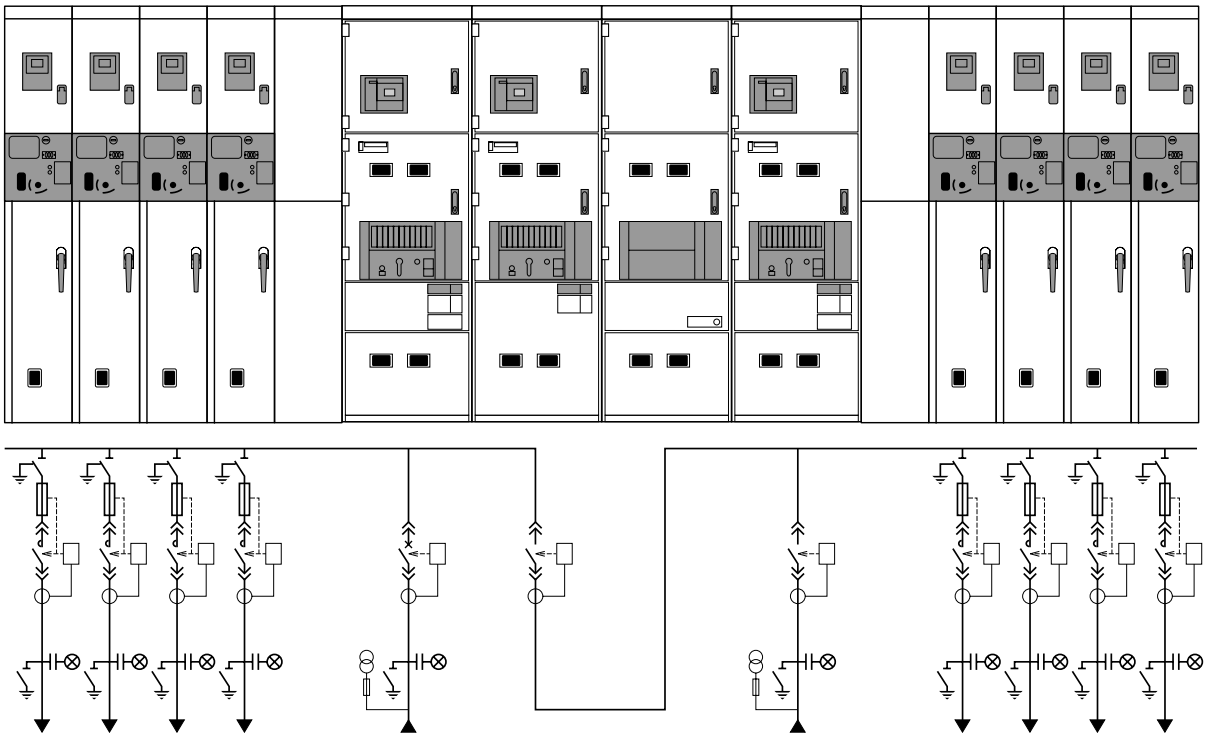
These values are approximate. Please check with the actual characteristics of the transformer to determine the fuse rating.

Service voltage (kV)	Transformer rating (kVA) 25	50	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500
3	125	125	125	125	125	125	125	125	125	125	160	200	250	2 x 200	2 x 250		
3.3	125	125	125	125	125	125	125	125	125	125	160	200	250	2 x 200	2 x 250		
5	125	125	125	125	125	125	125	125	125	125	125	125	160	200	250	2 x 200	2 x 250
5.5	125	125	125	125	125	125	125	125	125	125	125	125	160	160	250	2 x 200	2 x 250
6	125	125	125	125	125	125	125	125	125	125	125	125	125	160	200	250	2 x 200
6.6	125	125	125	125	125	125	125	125	125	125	125	125	125	160	200	250	2 x 200

For more information, see Fuses catalogue ref. AC0479EN ART.72747.

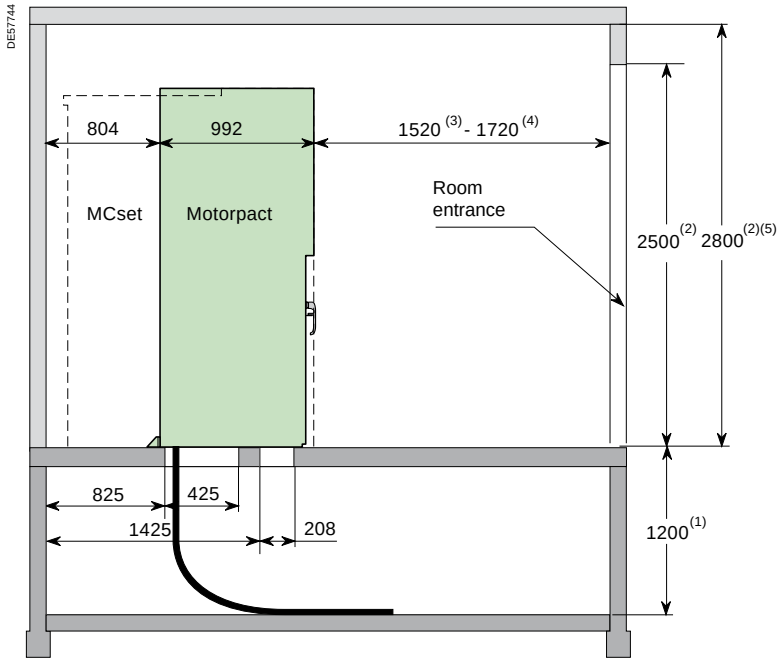
Implementation examples
Lined up switchboard

DE55505



Civil engineering with utility space

DE57744

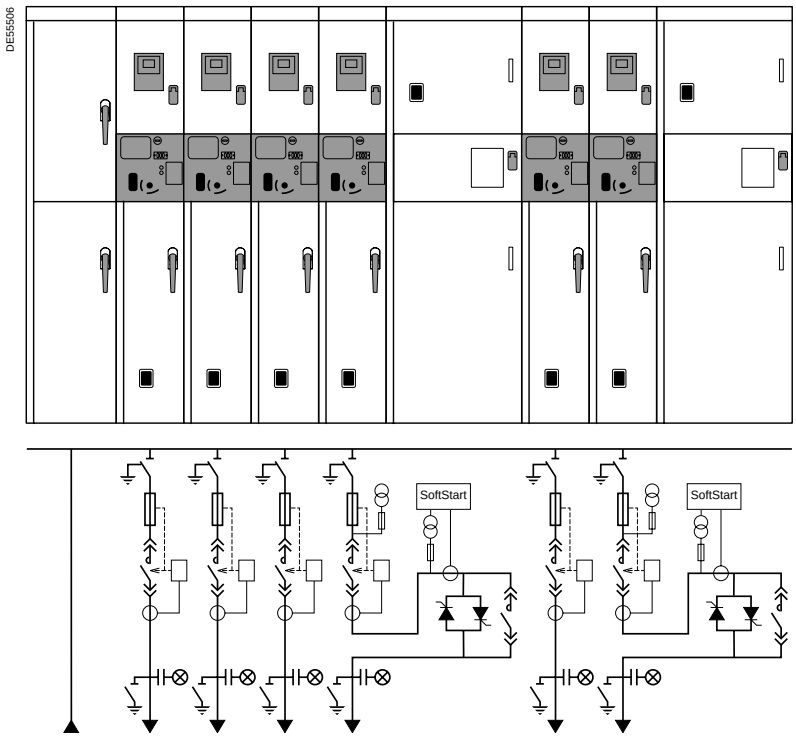


(1) Minimum dimensions to be defined according to the cable bending radius.

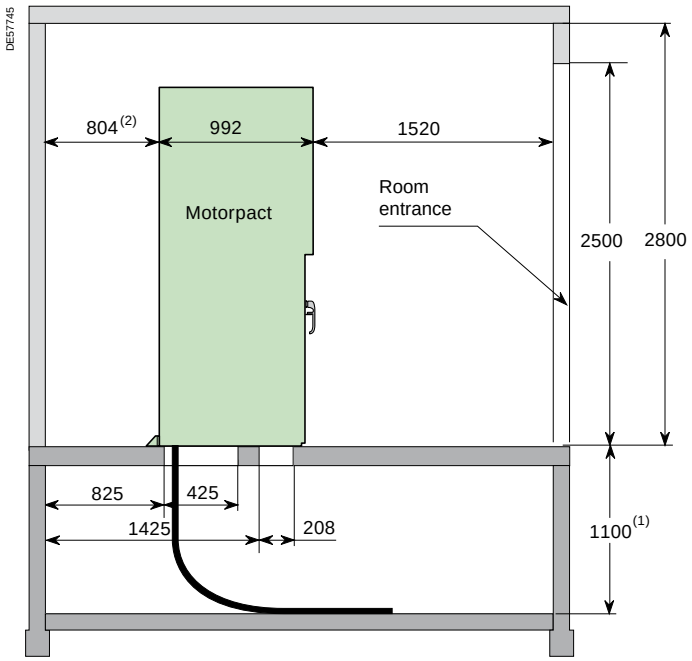
Note for lined up switchboard with MCset
(2) Minimum dimensions to be complied with when installing the MCset switchboard.
(3) Operating distance.
(4) Distance needed to extract a functional unit from the switchboard without moving the other units.
(5) Provide an exhaust tunnel above the switchboard when the room height is less than 4 metres.

For further information, refer to the civil engineering, user and instruction manual.

Implementation examples
Stand alone switchboard



Civil engineering with utility space for front and rear access



(1) Minimum dimensions to be defined according to the cable bending radius.
(2) Can be placed against the wall for single core cable applications or for single and three core applications if utility space provides bottom access for three core preparation and installation.

For further information, refer to the civil engineering, user and instruction manual.

FVNR: full voltage non reversing asynchronous motor starter

Only one of the boxes (ticked [X] or filled [ ] by the needed value) have to be considered between each horizontal line.
Green box [X] corresponds to none priced functions.

Basic unit cubicle

Quantity [ ]

Rated voltage		**3.6 kV** [ ]		**7.2 kV** [ ]
Rated short time withstand current	25 kA 3 s [X]	31.5 kA 3 s [ ]	40 kA 3 s [ ]	50 kA 2 s [ ]
Busbar		Bare [X]		Encapsulated [ ]
Rated current	630 A [ ]	1250 A [ ]	2500 A [ ]	3150 A [ ]
Rated operational current			200 A [X]	400 A [ ]
Degree of protection (housing)		IP3X [X]	IP4X [ ]	IPX1 [ ]
Maintenance free disconnector				[X]

Options

Internal arc withstand			25 kA-1 s/40 kA-0.5 s/50 kA-0.25 s [ ]
Ceiling height		< 4 m [ ]	> 4 m [ ]
Thermal diagnosis system			[ ]
Cable earthing switch			[ ]
Voltage presence indicator system (VPIS)			[ ]
Heating element			[ ]
Back light (disconnector contacts & load compartment)			[ ]
Key interlockings		Ronis [ ]	Profalux [ ]
Line disconnector			2O + 1C [ ]
Cable earthing switch			1O or 1C [ ]
Power factor correction	Voltage (kV) [ ]		Power (kVA) [ ]

(see the list page 38)

Main fused contactor

Removable vacuum contactor				
Electrically held				Basic equipment [ ]
Mechanically latched				[ ]
Open release			125 Vac [X]	250 Vac [ ]
		48 Vdc [X]	125 Vdc [X]	250 Vdc [ ]
MV fuses	50 A [ ]	63 A [ ]	80 A [ ]	100 A [ ]
125 A [ ]	160 A [ ]	200 A [ ]	250 A [ ]	2 x 250 A [ ]
Cable connection		Bottom [X]		Top [ ]
1 cable/phase (max. 240 mm²) [ ]			2 cables/phase (max. 120 mm²)	[ ]
Blown fuse indicator				[ ]

Options

Mechanical operation counter	[ ]
Surge arrestors (line side)	[ ]
Fused control power transformer (CPT)	[ ]
Fused voltage transformer	[ ]

Protection, metering and control

Sepam digital relay (see Sepam catalogue)		M20 [X]		Other [ ]
Transparent Ready option				[ ]
Local control				
2 push buttons, 2 indication lights [X]		L/R switch [ ]		Sepam 100MI [ ]
Phase current sensors		5 A CT [ ]	1 A CT [ ]	LPCT [X]
Zero sequence current sensors	ZSCT [ ]	CSH 120 [ ]	CSH 200 [ ]	CSH 280 [ ]

Sepam options

Additional logic I/O's module	MES114 [ ]
Analog output module	MSA141 [ ]
Temperature sensor acquisition module	MET148 [ ]
Modbus communication interface	ACE949 [ ]

RVAT: auto-transformer asynchronous motor starter

Only one of the boxes (ticked [X] or filled [ ] by the needed value) have to be considered between each horizontal line.
Green box [X] corresponds to none priced functions.

Basic unit cubicle

Quantity

Rated voltage		**3.6 kV**		**7.2 kV**
Rated short time withstand current	25 kA 3 s	31.5 kA 3 s	40 kA 3 s	50 kA 2 s
Busbar		Bare		Encapsulated
Rated current	630 A	1250 A	2500 A	3150 A
Rated operational current			200 A	400 A
Degree of protection (housing)		IP3X	IP4X	IPX1
Maintenance free disconnector				

Options

Internal arc withstand			25 kA-1 s/40 kA-0.5 s/50 kA-0.25 s
Ceiling height		< 4 m	> 4 m
Thermal diagnosis system			
Cable earthing switch			
Voltage presence indicator system (VPIS)			
Heating element			
Back light (disconnector contacts & load compartment)			
Key interlockings		Ronis	Profalux
Line disconnector			2O + 1C
Cable earthing switch			1O or 1C
Power factor correction	Voltage (kV) [ ]		Power (kVA) [ ]

(see the list page 38)

Main fused contactor

Removable vacuum contactor					
Electrically held					Basic equipment
Mechanically latched					
Open release				125 Vac	250 Vac
		48 Vdc		125 Vdc	250 Vdc
MV fuses		50 A	63 A	80 A	100 A
125 A		160 A	200 A	250 A	2 x 250 A
Cable connection			Bottom		Top
	1 cable/phase (max. 240 mm^2)			2 cables/phase (max. 120 mm^2)	
Blown fuse indicator					

Options

Mechanical operation counter	
Surge arrestors (line side)	
Fused control power transformer (CPT)	
Fused voltage transformer	

The auto-transformer is designed according to the motor requirements:

Nominal power	
Service voltage	
Nominal current	
Frequency	
Starting current	
Starting time (motor)	
Starting time (motor + auto-transformer)	
Number of starts/hour	
Number of consecutive starts	

Auto-transformer module

1 auto-transformer	
1 run vacuum contactor (electrically held)	
1 start vacuum contactor (electrically held)	

Options

Mechanical operation counter	
Contactor position indication windows	

Protection, metering and control

Sepam digital relay (see Sepam catalogue)		M41		Other
Transparent Ready option				
Local control				
2 push buttons, 2 indication lights		L/R switch		Sepam 100MI
Phase current sensors		5 A CT	1 A CT	LPCT
Zero sequence current sensors	ZSCT	CSH 120	CSH 200	CSH 280

Sepam options

Additional logic I/O's module	MES114
Analog output module	MSA141
Temperature sensor acquisition module	MET148
Modbus communication interface	ACE949

RVSS: SoftStart asynchronous motor starter

Only one of the boxes (ticked [X] or filled [ ] by the needed value) have to be considered between each horizontal line.
Green box [X] corresponds to none priced functions.

Basic unit cubicle

Quantity [ ]

Rated voltage		**3.6 kV** [ ]		**7.2 kV** [ ]
Rated short time withstand current	25 kA 3 s [X]	31.5 kA 3 s [ ]	40 kA 3 s [ ]	50 kA 2 s [ ]
Busbar		Bare [X]		Encapsulated [ ]
Rated current	630 A [ ]	1250 A [ ]	2500 A [ ]	3150 A [ ]
Rated operational current			200 A [X]	400 A [ ]
Degree of protection (housing)		IP3X [X]	IP4X [ ]	IPX1 [ ]
Maintenance free disconnector				[X]

Options

Internal arc withstand			25 kA-1 s/40 kA-0.5 s/50 kA-0.25 s [ ]
Ceiling height		< 4 m [ ]	> 4 m [ ]
Thermal diagnosis system			[ ]
Cable earthing switch			[ ]
Voltage presence indicator system (VPIS)			[ ]
Heating element			[ ]
Back light (disconnector contacts & load compartment)			[ ]
Key interlockings		Ronis [ ]	Profalux [ ]
Line disconnector			2O + 1C [ ]
Cable earthing switch			1O or 1C [ ]
Power factor correction	Voltage (kV) [ ]		Power (kVA) [ ]

(see the list page 38)

Main fused contactor

Removable vacuum contactor				
Electrically held				Basic equipment
Mechanically latched				[ ]
Open release			125 Vac [X]	250 Vac [ ]
		48 Vdc [X]	125 Vdc [X]	250 Vdc [ ]
MV fuses (Fusarc CF 442 mm)	50 A [ ]	63 A [ ]	80 A [ ]	100 A [ ]
125 A [ ]	160 A [ ]	200 A [ ]	250 A [ ]	2 x 250 A [ ]
Cable connection		Bottom [X]		Top [ ]
1 cable/phase (max. 240 mm^2) [ ]			2 cables/phase (max. 120 mm^2)	
Blown fuse indicator				[ ]

Options

Mechanical operation counter	[ ]
Surge arrestors (line side)	[ ]
Fused control power transformer (CPT)	Basic equipment
Fused voltage transformer	Basic equipment

SoftStart module (includes basic protection, metering and control)

1 SoftStart module	[X]
1 by-pass vacuum contactor (electrically held)	[X]
Voltage measurement	[X]
1 set of current sensors	[X]

Options

Mechanical operation counter	[ ]

Protection, metering and control (optional)

Sepam digital relay (see Sepam catalogue)				[ ]
Transparent Ready option				[ ]
Local control				
2 push buttons, 2 indication lights [X]		L/R switch [ ]		Sepam 100MI [ ]
Phase current sensors		5 A CT [ ]	1 A CT [ ]	LPCT [X]
Zero sequence current sensors	ZSCT [ ]	CSH 120 [ ]	CSH 200 [ ]	CSH 280 [ ]

Sepam options

Additional logic I/O's module	MES114 [ ]
Analog output module	MSA141 [ ]
Temperature sensor acquisition module	MET148 [ ]
Modbus communication interface	ACE949 [ ]

Transformer feeder

Only one of the boxes (ticked [X] or filled [ ] by the needed value) have to be considered between each horizontal line.
Green box [X] corresponds to none priced functions.

Basic unit cubicle

Quantity [ ]

Rated voltage			**3.6 kV**	☐		**7.2 kV**	☐
Rated short time withstand current		25 kA 3 s	■	31.5 kA 3 s	☐	40 kA 3 s ☐	50 kA 2 s ☐
Busbar			Bare	■			Encapsulated ☐
	Rated current	630 A	☐	1250 A	☐	2500 A ☐	3150 A ☐
Rated operational current						200 A ■	400 A ☐
Degree of protection (housing)			IP3X	■		IP4X ☐	IPX1 ☐
Maintenance free disconnector							■

Options

Internal arc withstand						25 kA-1 s/40 kA-0.5 s/50 kA-0.25 s	☐
	Ceiling height					< 4 m ☐	> 4 m ☐
Thermal diagnosis system							☐
Cable earthing switch							☐
Voltage presence indicator system (VPIS)							☐
Heating element							☐
Back light (disconnector contacts & load compartment)							☐
Key interlockings				Ronis	☐		Profalux ☐
	Line disconnector						2O + 1C ☐
	Cable earthing switch						1O or 1C ☐
Power factor correction		Voltage (kV) [ ]				Power (kVA) [ ]	

(see the list page 38)

Main fused contactor

Removable vacuum contactor

	Electrically held						Basic equipment
	Mechanically latched						☐
		Open release				125 Vac ■	250 Vac ■
				48 Vdc	■	125 Vdc ■	250 Vdc ■
MV fuses		50 A	☐	63 A	☐	80 A ☐	100 A ☐
	125 A ☐	160 A	☐	200 A	☐	250 A ☐	2 x 250 A ☐
Cable connection				Bottom	■		Top ■
	1 cable/phase (max. 240 mm²) ☐					2 cables/phase (max. 120 mm²)	☐
Blown fuse indicator							☐

Options

Mechanical operation counter	☐
Surge arrestors (line side)	☐
Fused control power transformer (CPT)	☐
Fused voltage transformer	☐

Protection, metering and control

Sepam digital relay (see Sepam catalogue)				T20	■	Other	[ ]
Transparent Ready option							☐
Local control							
	2 push buttons, 2 indication lights		■	L/R switch	☐		Sepam 100MI ☐
Phase current sensors				5 A CT	☐	1 A CT ☐	LPCT ■
Zero sequence current sensors		ZSCT	☐	CSH 120	☐	CSH 200 ☐	CSH 280 ☐

Sepam options

Additional logic I/O's module	MES114 ☐
Analog output module	MSA141 ☐
Temperature sensor acquisition module	MET148 ☐
Modbus communication interface	ACE949 ☐

Notes

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Schneider Electric Industries SAS
89, boulevard Franklin Roosevelt
F-92506 Rueil-Malmaison Cedex
Tel: +33 (0)1 41 29 85 00
www.schneider-electric.com

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